SAMPLING AND ANALYSIS PLAN

PHASE II SITE INVESTIGATION
J-1 AND J-3 RANGES
CAMP EDWARDS, MASSACHUSETTS

APRIL 20, 2000

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CAMP EDWARDS MASSACHUSETTS

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

Harding Lawson Associates (HLA) has prepared this Sampling and Analysis Plan (SAP) for Textron Systems Corporation (TSC) to address the performance of an ASTM Phase II Environmental Site Assessment (ESA) at the J-1 and J-3 Ranges, Camp Edwards Massachusetts (Figure 1-1). This Phase II ESA will be conducted in conformance with ASTM Standard Practice No. E1903-97.

HLA, under contract to TSC, has completed an ASTM Phase I ESA of the J-1 and J-3 Ranges. This Phase I ESA was conducted to support the site closure of J-3 Range under the requirements of TSC's license agreement with the U.S. Army Corps of Engineers, New England District (COE-NAE). The Phase I ESA has identified several potential Recognized Environmental Conditions (RECs). The objective of this ASTM Phase II ESA is to evaluate the potential environmental impacts of each REC identified in the Phase I ESA.

1.2 SITE DESCRIPTION AND HISTORY

The Massachusetts Military Reservation (MMR) is located on the upper or western portion of Cape Cod in Barnstable County, Massachusetts, approximately 60 miles south of Boston and immediately southeast of the Cape Cod Canal (Figure 1-1). The towns of Falmouth, Bourne, Sandwich, and Mashpee, intersect on MMR property. MMR consists of approximately 21,000 acres of land primarily owned by the Commonwealth of Massachusetts and operated by several cooperating tenants (Figure 1-2). These tenants include: the Massachusetts Army National Guard [(MAARNG) Camp Edwards]; the Massachusetts Air National Guard [(MAANG) Otis Air National Guard Base]; the U.S. Air Force (USAF, 6th Space Warning Squadron); the U.S. Coast Guard (Air Station Cape Cod); the Veteran's Administration; the U.S. Marine Corps; the U.S. Department of Agriculture; the Federal Aviation Administration; and TSC (Massachusetts Military Division, 1996). Military use of portions of MMR began as early as 1911, when the Massachusetts National Guard periodically camped, and conducted maneuvers and weapons training in portions of the Shawme Crowell State Forest. The majority of activity at MMR has occurred since 1935, when Camp Edwards was first established for the purpose of National Guard Army Reserve training.

The ranges at Camp Edwards have undergone numerous changes since range use first began. Over the years a number of ranges, including ranges formerly located on or adjacent to the J-1 and J-3 Ranges, have been abandoned, moved, and/or renamed. Historically, at least six former ranges were located at the J-1 and J-3 Ranges. These ranges include:

- H Range (three locations);
- I Range;
- Infiltration Course (current location of L Range); and,
- M-4 Range.

These former ranges, and the existing L Range that is located between the J-1 and J-3 Ranges, have potentially affected environmental conditions at both J-1 and J-3 Ranges. An overview of the operations

conducted at the J-1 and J-3 are provided below. Operations at the H, I, L, and M Ranges, and the former Infiltration Course are described in the Phase I ESA (HLA, 2000).

J-1 Range

TSC conducted operations and munitions testing at the J-1 Range between 1980 and 1986 under contract with the U.S. Army, Picatinny Arsenal (Figure 1-3). These activities were conducted under a Permit for Use of Certain Facilities at the Camp Edwards Army National Guard Training Site issued to AVCO by MAARNG on 1 July 1983. The permit expired 30 May 1988. This permit allowed for the construction of safety mounds, noise reduction barriers, the extension of two existing earth mound tunnel barriers, and installation of two 30-foot telephone poles to test high-explosive anti-tank (HEAT) munitions. TSC and the MAARNG completed the formal closure of this "use permit" in 1989, including the collection and analysis of soil samples.

MAARNG and several Department of Defense (DOD) contractors used J-1 prior to TSC operations which began in 1980. The J-1 Range was constructed in the late 1940s as a rifle transition range, which had nine firing lanes and several pop-up targets at various distances up to 500 yards. Reportedly, the transition range was used into the 1950s, and only .30 caliber ball and tracer ammunition was fired. Prior DOD contractors include American Potash and Chemical Corporation (believed to now be known as National Northern Division), Atlantic Research, and Norris Industries/Hesse-Eastern Division. These contractors used the range to test various tank, howitzer and mortar ammunitions.

J-3 Range

The J-3 Range consists of approximately 30 acres of land located near the eastern edge of MMR, north of Greenway Road in the town of Sandwich, Massachusetts. At the J-3 Range, TSC developed and tested military munitions under several license agreements with the COE-NAE, the first being executed in 1968. TSC's facilities at J-3 consist of the following: workshop building; explosive loading building (Melt-Pour Facility); ordnance assembly/X-ray building; instrumentation trailer; environmental test/assembly building; two test towers; four explosive storage bunkers; and several test range areas (Figure 1-4). The explosives loading building, established in 1979, was used to load explosives for the warheads TSC designed and tested. The ordnance assembly building was used to assemble, x-ray, and determine mass properties of the munitions loaded by TSC. The environmental test/assembly building was used for testing munitions and auxiliary ordnance assembly. The four explosive storage bunkers were used to store explosives, propellant, fused ammunition, and explosive waste.

The J-3 Range was established (in its current location) for AVCO (TSC) as a test range in 1968. The primary mission of TSC at the Site has been to develop and test tactical weapon systems for the U.S. Army and USAF. TSC operations at the Site were conducted under contract with the U.S. Army Armament Research and Development Command (ARRADCOM) and other DOD agencies. TSC ceased regular activities at the J-3 Range in 1997 following a cease and desist order for all live firing activities at Camp Edwards issued to MAARNG by the U.S. Environmental Protection Agency (USEPA). This cease and desist order continues to be in place at Camp Edwards.

The majority of activity conducted at the Site has included the loading, assembly, and explosive testing of developmental tactical ordnance items. Other TSC activities included evaluation of warhead

deployment techniques, such as parachute drop, launcher deployment, and on-board sensor evaluation. These system tests typically required some mechanical assembly, and were generally conducted with inert warhead simulators. Ordnance ammunition testing, such as 20 millimeter (mm) and other miscellaneous munitions testing was also performed at the Site. A detailed discussion of the tests performed at the Site is presented in the Phase I ESA Report (HLA, 2000).

Historic records indicated that a total of 11 depleted uranium (DU) test warheads were explosively loaded at the Site between December 1982 and November 1984. Each of these warheads was shipped from J-3 to the Terminal Effects Research and Analysis (TERA) test facility in Socorro, New Mexico for testing between 1982 and 1984. TSC activities at the Site were limited to explosive loading operations and did not include liner fabrication or test firings of DU munitions at Camp Edwards.

The area of the J-3 Range was previously part of the first H Range, that was used as a mortar range between 1935 and 1941. The southwestern portion of J-3 (vicinity of Instrumentation Building, Figure 1-4) was reportedly used as a target area for the H Range. From the 1950s until the early 1960s, the former H Range was used as a squad combat firing range. The exact location of this range was not known; however, 0.30 caliber and 7.62mm ammunition were used at this range. From the early 1960s to the late 1980s, there was no H Range designated at Camp Edwards. The existing H Range was constructed at its present location on Pocasset-Forestdale Road (approximately 1,500 – 2,000 meters southwest of J-3) in the late 1980s.

1.3 IDENTIFICATION OF AREAS OF CONCERN

This Section summarizes the findings of the Phase I which resulted in the identification of 11 separate Areas of Concern (AOC). For the purposes of this Phase II, AOCs are defined as those areas where RECs, as defined in the ASTM E 1527-97 (Phase I guidance), may be present. RECs are defined as the presence or likely presence of any oil or hazardous material (OHM) on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any OHM into structures, the ground, groundwater, or surface water of the property. Each of the 11 AOCs and the associated RECs are described in the following paragraphs.

AOC 1: Loading Building

The Loading Building is located in the southwestern portion of the J-3 Range (Figure 1-4). This building was designed to provide facilities for operations related to the loading of high explosives such as: melt-pour explosive loading, hydraulic press consolidation explosive loading, explosive machining, and mechanical inspection. Wastewater from loading operations was managed in two ways. Initially, this water was discharged to a 1,500 gallon subsurface holding tank located outside the northwest corner of the building. In 1990, the holding tank was replaced by a process wastewater recirculation system located inside the building. Non-process water from the wash sink and mechanical room floor drain emptied into a leach tank located outside the northeastern corner of the building.

Three RECs have been identified for Phase II evaluation at the Loading Building AOC. The first REC relates to evidence of a release of process water to the environment from the 1,500-gallon holding tank. The release reportedly occurred in approximately 1983 or 1984. On this occasion, the tank was pumped out and the process water (estimated to be 1,200 gallons) was discharged onto the ground surface

approximately 100 feet southwest of the Loading Building (Figure 1-5). Note that on a separate occasion, the water was pumped into 55-gallon drums which were emptied out at the J-1 Range (see AOC 10). These drums were later flattened and buried below an earthern berm (see AOC 11).

The former location of the 1,500 gallon tank has been identified as the second REC since there are no records of environmental testing of soils below the tank associated with the 1990 decommissioning and removal. The third REC is the potential presence of explosives in the non-process water leach tank as the result of hand washing by personnel after handling explosives.

AOC 2: 20 mm Range

The 20 mm Range is located in the southeastern portion of J-3 (Figure 1-4). This range was used for various tests of 20mm and 30mm rounds. These rounds were fired at aluminum sheet targets approximately 100 and 800 feet down range. Steel knockdown plates were positioned 45 feet behind the targets and protective soil berms were located further down range. Some of the ammunition used at this range contained explosives. A total of approximately 13,000 rounds of ammunition were fired. At least a portion of these rounds were non-ricochet rounds that were formed from powdered metal. These rounds disintegrated upon contact with a target. Only one 20mm round is known not to have detonated on impact with the steel knockdown plate. This round was retrieved for analysis and detonation.

The potential exists for residual metals to be present in soil at the target area and in the immediate vicinity of the former steel knockdown plates where the non-ricochet rounds would have been pulverized. These metals include steel, copper, and aluminum. The potential also exists for explosives residual within the surface soil immediately outside the firing point and at the detonation points. Therefore, each of these areas has been identified as a REC.

AOC 3: Former Flammable Storage Shed and Burn Kettle

The Burn Kettle Area is located in the southwestern portion of J-3 (Figure 1-4). Former structures in this area include a flammable storage shed, a burn kettle, and four CONEXs, none of the structures/facilities described above are still in place (Figure 1-6). The flammable storage shed was used to store limited quantities of gasoline, diesel fuel, and motor oil. The burn kettle was previously located immediately southeast of the former flammable storage shed. This burn kettle was used to burn excess propellant and unexploded ordnance by TSC and others. This kettle was partially buried in the ground with dirt mounded up against it on all sides.

The REC at the former flammable storage shed is the potential release of small quantities of gasoline, diesel fuel, and/or motor oil to the ground surface beneath the shed. For the former burn kettle, the REC is the potential for the area around the kettle to have been impacted by the burning of excess propellant and unexpected ordnance.

AOC 4: Workshop Building Dry Well

The Workshop Building is located in the southeastern portion of the Site. The building now or formerly included a washing machine and dryer, a storage room converted into a small photography darkroom, an office, and a work area. The workshop area was equipped with some metal and woodworking tools. The

darkroom was used for photo processing until 1983 at which time photo processing operations were moved to the Assembly Building (see AOC 9). Although the piping is no longer in place, rinse water from the photo processing was discharged to what appears to be a dry well located adjacent to the northwest corner of the building (Figure 1-7). The Workshop dry well has been identified as a REC because of the potential for there to be residuals in the dry well from photo processing rinse water.

AOC 5: Warhead Firing Range

The warhead test firing range is located in the eastern central portion of the J-3 Range and was used for the testing of explosively formed projectile (EFP) used to pierce through armor plating. The warhead testing structure consists of a concrete flight line approximately 175 feet in length and 11 feet wide along which the warhead would travel (Figure 1-8). The charge used to propel the EFP originated in a concrete block building located at the southern most end of the concrete flight line. An explosive bursting charge was detonated within the concrete block building to propel the EFP downrange and provide the energy to transform it into an armor-piercing munition. The EFP does not contain a supplementary explosive so there is no explosive detonation caused on impact or after penetration of the armor plate.

At least 688 warhead tests were conducted at J-3 between 1979 and 1997. Over the duration of the testing various explosives were used including: Composition B (consisting of approximately 60% Royal Dutch Explosives [RDX] and 40% trinitrotoluene [TNT]); Octol (a mixture of 70% to 80% Her Majesties Explosives [HMX] and 20% to 30% TNT); and plastic bonded explosive [PBX] (approximately 90% to 95% HMX and 5% to 10% plastic bonding compounds). The casing itself was constructed of steel, copper, and/or tantalum. There was no lead within the munitions casing. The REC at the former warhead testing range include the potential presence of explosives residual in the surface soil immediately surrounding and downrange from the detonation chamber.

AOC 6: Artillery Range

The artillery range is located in the central portion of the J-3 Range and was first used by TSC in 1968. Currently, this area consists of two reinforced concrete targets (Target No. 1 and Target No. 2 on Figure 1-8). Four gun emplacements (guns mounted on concrete pads) were formerly located south of the targets. An instrumentation trailer is present south of the gun emplacements. A 75-foot drop tower also exists within the artillery range. The artillery range was reportedly used for testing 8-inch rounds until 1983. Other types of munitions used on the artillery range may have included M-159 signal flares, 40mm grenades, and 81mm mortar rounds. The RECs at this area include the potential release of metals and explosives to soil resulting from past operations at the artillery range.

AOC 7: J-3 Demolition Area

The Demolition Area is located in the central portion of J-3 north of the artillery range targets (Figure 1-4). Significant features of this area include a burn box and a former unlined detonation pit (Figure 1-8). This burn box was constructed of heavy-gauge steel grates set upon a metal pan that sat atop a concrete pad. Within the demolition area various munitions, excess and/or off-spec propellants, and explosive wastes were either burned/detonated in the detonation pit, burned within the burn box, or placed immediately behind (north of) the concrete wall and burned. When necessary, diesel fuel was used to accelerate the burning of these materials. In addition, a small number of tests on antitank mines

were conducted immediately north of the concrete walls by Foster-Miller Associates, and supported by TSC personnel.

The REC at the Demolition Area is the potential release of explosives, petroleum products (diesel fuel), and metals. Because the demolition pit is unlined and rainwater collects there, a potential for explosives and other residuals to be present in the subsurface exists.

AOC 8: Giant Patriot Testing Area

The Giant Patriot Testing Area is located northeast of the Warhead testing range, along the eastern boundary on J-3 (Figure 1-8). The area was used to test the self-destruct system of the Minuteman 1 Missile. Only 50 to 60 tests were conducted over a three to four month period in 1977 as part of this program, but each used a large amount of explosives (approximately 40-pound charges). The REC is the potential for explosives to have been released to soils due to the detonation of warheads and third stage target explosives.

AOC 9: Assembly Building Septic

The Assemble Building is located in the northwestern portion of the J-3 Range (Figure 1-4). The Assembly Building septic tank has been identified as a REC because of the potential for there to be residuals in the tank from photo processing rinse water which was generated in this building.

AOC 10: J-1 Range Suspected Process Water Discharge Area

Approximately 1,200 gallons of process wastewater from the Loading Building was reportedly released into an existing depression between the two telephone poles at the 1,000-meter range target area on the J-1 Range (Figure 1-3). Reportedly, this release was a one-time event that occurred sometime between 1980 and 1987. Process wastewater was generated from the milling of explosives at the Loading Building and from cleaning the Melt-Pour bay after each casting. Therefore the REC at this AOC is the potential release of explosives residuals to the environment with the disposal of the process water.

AOC 11: Process Water Empty Drum Area

After the process water disposal event on the J-1 Range (AOC-10), the empty 55-gallon drums (approximately 27) were transported back to J-3 Range where they were flattened and disposed of as metal scrap in the area to the northeast of the warhead firing range (Figure 1-8). The crushed drums were reportedly stacked approximately four feet high and covered with several feet of soil. The REC associated with this AOC is the potential for soil below the drums to have been impacted by a release of the residual explosive-containing process water which may have been present in the drums at the time they were buried.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT STAFFING AND RESPONSIBILITIES

The HLA project staff includes:

Project Manager: David Heislein	**Technical Review:** David Heislein/Robert Nicoloro
Task Manager: David McCabe	**Field Operations Leader:** Mark Phaneuf
Health & Safety Manager: Cynthia Sundquist	**Quality Assurance Manager:** Willard Murray
Data Validation/Laboratory Services Coordinator: Kelly Helleur	**Health and Safety Officer:** Mark Phanuef

HLA field personnel will be supported by subcontractors who will perform drilling and well installations, surveying, unexploded ordnance (UXO) screening and laboratory services. The key roles for HLA personnel are discussed in the following Subsections.

2.1.1 Task Manager

The Task Manager is David McCabe. He is responsible for evaluating the appropriateness and adequacy of the technical services provided for the task, and for developing the technical approaches and levels of effort required to address each task. Mr. McCabe is also responsible for the day-to-day conduct of work for this Phase II ESA, including integration of input from supporting disciplines and management of subcontractors (i.e., drilling and laboratory subcontractors). The Task Manager will review the on-going quality control (QC) during the performance of work, the technical integrity of conclusions and recommendations, and the clarity and usefulness of all task work products. Specific responsibilities of the Task Manager include the following activities:

- overall responsibility for the task;
- initiating project activities;
- participating in work plan preparation and staff assignments;
- identifying and fulfilling equipment and other resource requirements;
- monitoring task activities to ensure compliance with established budget, schedules, and scope of work; and
- interacting regularly with Project Manager, TSC, and others (as appropriate) regarding task status

2.1.2 Technical Review Committee

David Heislein and Robert Nicoloro comprise the Technical Review Committee for the project, with Mr. Heislein as the lead reviewer. Both Mr. Heislein and Mr. Nicoloro are responsible for providing guidance and oversight on the technical aspects of the project, and providing technical review of all

project deliverables. They will also assist the Task Manager by reviewing technical aspects of the project to ensure that services (1) reflect the accumulated experience of the firm; (2) are produced in accordance with corporate policy and the ASTM Phase II Guidance; and (3) meet the intended needs of TSC's license closure requirements. Their primary function is to ensure the application of technically sound methodologies and the development of defensible data, interpretations, and conclusions.

2.1.3 Health and Safety Manager

Cynthia Sundquist, Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP), is HLA's Health and Safety Manager. She, along with the site Health and Safety Officer (HSO), Mark Phaneuf, will be responsible for the performance of the site-specific health and safety procedures necessary for protecting field personnel from potential hazards, for conducting health and safety briefings in the field for all personnel, and for tracking all health and safety related activities.

2.1.4 Field Operations Leader

Mark Phaneuf is the Project Geologist and Field Operations Leader (FOL), and will be responsible for organizing, scheduling, and implementing all field activities. He has participated in the preparation of the project plans to date, and will be in charge of day-to-day field activities and direction of subcontractors at the site. Mr. Phaneuf will be in frequent communication with the Task and Project Managers, and will make recommendations for any additional activities, if warranted. He will also be responsible for the maintenance of field records and documentation through the completion of sample collection activities.

2.1.5 Data Validation Manager/Laboratory Services Coordinator

Kelly Helleur will serve as Data Validation Manager/Laboratory Services Coordinator (LSC), and be responsible for tracking and coordinating with the subcontracted laboratory. Ms. Helleur will interact with the laboratory contacts, Project Manager, and FOL to ensure that sample delivery and analyses will be completed appropriately and in a timely fashion. She will be responsible for maintenance of the field records and sampling documentation once the field program is completed, and will report any problems to the FOL and Project Manager. Ms. Helleur will also be responsible for coordination of the data validation activities, which will be performed by chemists in HLA's Portland, Maine office.

2.2 LABORATORY ANALYTICAL SERVICES

HLA has established a subcontract agreement with Katahdin Analytical (Westbrook, ME) and STL Laboratories (Colchester, VT). These contract laboratories will provide chemical analytical services for the project. Section 3.11 discusses the detection limits that the contract laboratory will be required to meet.

3.0 FIELD ACTIVITIES

3.1 SCOPE AND OBJECTIVES

HLA, under contract to TSC, has completed an ASTM Phase I ESA of the J-3 and J-1 Ranges, to support the site closure of J-3 Range in accordance with TSC's license agreement with the COE-NAE. The Phase I ESA identified 11 AOCs, each with one or more REC. The objective of this ASTM Phase II ESA is to evaluate the potential environmental impacts of each REC identified in the Phase I ESA. HLA will conduct this Phase II ESA in accordance with the *ASTM Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process*, designated ASTM Standard Practice No. E 1903-97. This Phase II ESA will also be undertaken in a manner consistent with the Massachusetts Contingency Plan (MCP; 310 CMR 40.000). However, this ESA is not intended to meet the requirements of a MCP Phase II Comprehensive Site Assessment.

Based on the findings of the ASTM Phase I ESA, the field activities which will be undertaken as part of this ASTM Phase II will include:

- Collection of surface soil samples from the locations of former gun positions, targets, knock down plates, and berms (AOCs 2, 5, 6, and 8) to assess these areas for the potential presence of residual propellants or explosives and metals from the fragmentation of projectiles and casings.

- Collection of surface soil samples and advancement of soil borings for the collection of subsurface soil samples at the Demolition Area (AOC 7) on the J-3 Range. These samples will be evaluated for the presence of explosives, metals, and fuel residuals.

- Collection of surface and subsurface soil samples at the two suspected process water discharge areas (AOC 1 and AOC 10) and the empty process water drum burial area (AOC 11) to evaluate these areas for the presence of residual explosives.

- Installation and sampling of small diameter driven wells (SDDWs) to assess the potential impact to groundwater of the suspected process water discharge areas (AOC 1 and AOC 10).

- Collection of surface soil samples from the locations of former flammable storage shed and burn kettle (AOC 3) to evaluate these areas for the presence of explosives, metals, and fuel residuals.

- Collection of sediment from the Workshop dry well (AOC 4) and Assembly Building septic tank (AOC 9) to evaluate these structures for photo processing residuals and collection of sediment from the Loading Building leach tank (AOC 1) to evaluate this structure for the potential presence of explosives.

The Phase II sampling locations are shown on Figures 3-1 through 3-5. Field activities conducted by HLA will be performed in conformance with a Site Safety and Health Plan that will be developed for the execution this work.

3.2 EQUIPMENT AND SUPPLIES

The equipment and supplies required to support field activities are listed in Tables 3-1 and 3-2. Table 3-1 presents a summary of the non-expendable equipment necessary for environmental monitoring, multi-media sampling, health and safety monitoring, equipment and personal decontamination, and general field operations. Table 3-2 summarizes the expendable supplies required for the field investigation. Equipment handling, maintenance, and calibration procedures for environmental monitoring instruments are summarized in the following paragraphs:

- Field equipment providing measurements of a chemical or physical parameter will have approved manufacturer's instructions for operation, calibration, and maintenance with them at the field staging location. Updates and/or revised instructions will be provided to field personnel with the instruments and will also be maintained at the Portland Field Operations Support office.

- Field instruments that have physical or chemical standards appropriate for the accurate operation of the equipment will be calibrated on a routine basis to verify the accuracy of the measurements for each instrument. Physical or chemical standards will be traceable to a known, recognized standard. Standards will be documented as to origin, date of receipt, and date of expiration if applicable. This information will be recorded and maintained at the field staging location.

- Field instruments will be inspected daily and calibrated at least once per day, depending on the instrument and field conditions. Field personnel performing daily calibrations will document the findings of the calibration event on a Calibration Data Sheet (Figure 3-6), with recommendations for further actions, if required.

Equipment not in compliance with its calibration criteria will be removed from use until it is repaired. If prior measurements made by the instrument are in question, they will be reported to the Task Manager through the FOL and recorded in the daily log.

3.3 MOBILIZATION

HLA field team and subcontractor personnel meetings will be held prior to implementation of fieldwork. Meetings will focus on project health and safety requirements, including the HLA policies and procedures to be followed.

3.4 UXO SCREENING

UXO screening will be performed for each sampling location and access way, not previously screened or otherwise documented as safe for passage. Surface soil sampling locations will be cleared to a depth of two feet, suspected UXO will be flagged and sampling locations adjusted accordingly. Soil boring and well installation locations will be cleared at two-foot depth intervals in advance of the drilling tools, to a depth of 10 feet.

3.5 SURFACE SOIL SAMPLING

As stated above, HLA intends to collect surface soils for laboratory analysis on the Ranges to examine this media for the presence of residual explosives, metals, petroleum hydrocarbons, and potentially (if

screening indicates they may be present) volatile organic compounds (VOCs). This Section discusses the rationale for Phase II surface soil sample location, collection, analysis, and quality control. The Phase II sampling and analytical program is summarized in Table 3-3, and surface soil sampling locations are shown on Figure 3-1 through 3-5.

3.5.1 Surface Soil Sampling Locations

AOC 1 Loading Building: Soil sampling will be undertaken to evaluate the presence of explosives in surface soils from the reported discharge of process water from the 1,500-gallon capacity concrete holding tank to the ground surface 100 feet southwest of the Loading Building. The process water discharge event reportedly occurred in the either 1983 or 1984. The holding tank was removed in approximately 1990. HLA will establish a 40 feet by 40 feet grid centered on the area of suspected release (Figure 3-1). A total of 13 samples will be collected from the grid.

AOC 2: 20 mm Range: Surface soil sampling will be undertaken at the 20 mm firing range to evaluate the potential presence of explosives and metals. Three samples will be collected in front of the former firing building to evaluate for the presence of propellants and metals from casing residuals. Three samples will also be collected at the 100-foot target, knock down plate, and capture mound, for a total of 12 samples (Figure 3-2).

AOC 3: Former Flammable Storage Shed and Burn Kettle Area: Two surface soil samples will be collected from the area below the former flammable storage shed to address the potential for releases of the stored materials (i.e., gasoline, diesel fuel) to have leaked through the rusted floor of the shed. Three surface soil samples will be collected in the area of the former burn kettle to address the potential for burning activities to have impacted surface soils (Figure 3-3).

AOC 5: Warhead Firing Range: Two surface soil samples will be collected in the vicinity of the detonation chamber to address potential concerns regarding the presence of explosives and metals in soils as a result of EFP testing (Figure 3-4).

AOC 6: Artillery range: Surface soil samples will be collected from the areas of the four former gun positions and the two concrete targets, to determine if explosive residuals or metals are present in soil (Figure 3-4). Four samples will be collected at each of the former gun positions and pairs of these samples will be composited, as a result, a total of two samples per gun position will be submitted for laboratory analysis. In addition, two samples will be collected from the soil at the base of Target 1 and three samples from the base of Target 2. A total of 13 samples from this AOC will undergo laboratory analyses.

AOC 7: Demolition Area: Four surface soil samples will be collected from each of the following locations: the area of the burn box, the demolition pit area, and the north side of Target 2 (Figure 3-4). A total of 12 samples from this AOC will be submitted for laboratory analyses.

AOC 8: Giant Patriot Testing Area: The potential exists for explosives residual within the surface soil in the Giant Patriot testing area due to detonation of both the warheads and third stage target explosives. HLA will establish a 40-foot by 80-foot grid in this area from which a total of eight surface soil samples will be collected (Figure 3-4).

AOC 10: J-1 Range Suspected Process Water Disposal Area: Similar to the Loading Building, sampling will be undertaken at this AOC to evaluate the presence of explosives in surface soils from the reported discharge of 1,200 gallons of process water. The release reportedly occurred in the either 1983 or 1984 into an existing depression between the two telephone poles at the 1,000-meter range target area. Samples will be collected based on a 40 foot by 40 foot grid centered on the suspected release point (Figure 3-5). A total of 13 samples will be collected from the grid.

3.5.2 Surface Soil Sample Collection Methods

Soil samples will be collected using a stainless steel spoon and will be placed in a stainless steel bowl. If a VOC sample is to be collected, it will be collected as a grab sample prior to sample compositing. For all other analytes, the sample will be a composite of the zero to six inch depth intervals. Soil textures, other visual observations, odors, and photoionization detector (PID) meter readings will be recorded for each sample. To minimize the potential for cross-contamination, sampling equipment will be decontaminated between the retrieval of successive samples. The sample material will be observed and documented using procedures outlined as follows:

1. Scan the soil with a PID and record the reading. Note the physical characteristics of the soil, including soil classification nomenclature, color, particle size, moisture content, and staining or odors (if present).

2. For VOC headspace screening, fill an 8-ounce reference jar halfway, cover the mouth with aluminum foil, and cap the jar.

3. For samples that are to be submitted for off-site analysis, place the sample soil in the containers (using a clean stainless steel spatula) in the following order: (a) Fill the methanol-preserved VOC jars first, avoiding mixing or disturbing the natural packing, (b) Fill a clean stainless steel bowl with enough sample material to fill laboratory containers. Once the sample has been thoroughly mixed, containers for shipment to the laboratory will be filled from the temporary container.

4. Decontaminate the sampling device according to the procedure outlined in Section 3.10.

Soil sampling data will be recorded in the field logbook.

3.6 Dry Welland Leach/Septic Tank Sampling

HLA intends to collect sediment from one dry well, one leach tank and one septic tank for laboratory analysis to examine this media for the presence of residual explosives and photo chemicals.VOCs. In addition, if standing water is present then a sample of that media will be collected and analyzed for the same parameters as the sediment. This Section discusses the rationale for Phase II sediment sample location, collection, analysis, and quality control. The Phase II sampling and analytical program is summarized in Table 3-3, and surface soil sampling locations are shown on Figure 3-1 and 3-2.

3.6.1 Dry Well and Leach/Septic Tank Sampling Locations

AOC-1 Loading Building: To evaluate the possible presence of explosives within the Loading Building leach tank, HLA will collect one sediment sample for explosives analysis. If present, standing water in the leach tank will also be sampled and analyzed for explosives.

AOC-4 Workshop Building: A possible dry well was identified outside the northwest corner of the building adjacent to the former photographic darkroom and the former laundry. To evaluate whether releases to the dry well from the former darkroom have occurred, one sediment sample will be collected and analyzed for priority pollutant metals. If present, standing water in the dry well will also be sampled and analyzed for metals.

AOC-9 Assembly Building Septic Tank: To evaluate whether releases to the septic tank from the former darkroom have occurred, one sediment sample will be collected and analyzed for priority pollutant metals. If present, standing water in the septic tank will also be sampled and analyzed for metals.

3.6.2 Dry Well and Leach/Septic Tank Sample Collection Methods

Sediment samples will be collected using a long handled Teflon© sampler and will be placed in a stainless steel bowl. If a VOC sample is to be collected, it will be collected as a grab sample prior to sample compositing. For all other analytes, the sample will be a composite of upper six inches of sediment. Sample textures, other visual observations, odors and PID meter reading, will be recorded for each sample. To minimize the potential for cross-contamination, sampling equipment will be decontaminated between the retrieval of successive samples. The sample material will be observed and documented using procedures outlined as follows:

1. Scan the sample with a PID and record the reading. Note the physical characteristics of the sample, including color, particle size, moisture content, and staining or odors (if present).

2. For VOC headspace screening, fill an 8-ounce reference jar halfway, cover the mouth with aluminum foil, and cap the jar.

4. For samples that are to be submitted for off-site analysis, place the sample in the containers (using a clean stainless steel spatula) in the following order: (a) Fill the methanol-preserved VOC jars first, avoiding mixing or disturbing the natural packing, (b) Fill a clean stainless steel bowl with enough sample material to fill laboratory containers. Once the sample has been thoroughly mixed, containers for shipment to the laboratory will be filled from the temporary container.

4. Decontaminate the sampling device according to the procedure outlined in Subsection 3.10.

Sediment sampling data will be recorded in the field logbook. Aqueous samples will be collected using a long handled Teflon© sampler and transferred directly into the appropriate sample containers (Table 3-10).

3.7 DRILLING AND SUBSURFACE SOIL SAMPLING

HLA intends to collect subsurface soils for laboratory analysis to examine this media for the presence of residual explosives, metals, petroleum hydrocarbons, and potentially VOCs. This Section discuss the rationale for Phase II subsurface soil sample location, collection, analysis, and quality control. The Phase II sampling analytical program is summarized in Table 3-3. Subsurface soil sampling locations are shown on Figures 3-1, 3-4, and 3-5.

3.7.1 Soil Boring Locations

AOC 1 Loading Building: Subsurface soil sampling will be conducted to evaluate the potential presence of explosives in subsurface soils resulting from the reported discharge of process water from the 1,500-gallon capacity concrete holding tank to the ground surface 100 feet southwest of the Loading Building, as previously described. This characterization will only be undertaken if explosives are detected in surface soils. If detected, one boring will be advanced at the location of the highest surface soil detection of explosives. The boring will be sampled continuously to a depth of 16 feet below ground surface (bgs). Samples from the 2-4, 6-8 10-12 and 14-16 foot depth intervals will be submitted to the laboratory for potential explosives analysis. It is anticipated that initially only the 2- 4 foot sample grade will be analyzed for explosives. Deeper soil samples will be retained by the laboratory and may be analyzed later, if explosives are detected in the 2-4 foot sample.

Subsurface soil sampling will also be undertaken to determine if a release has occurred from the former 1,500 gallon process water holding tank which was removed in 1990. Two soil borings will be advanced to a depth of 16 feet below the former tank location. One sample from each boring location from below the base of the former tank (8-10 foot depth interval) will be analyzed for explosives. Deeper soil samples (10-12 foot, 12-14 foot and 14-16 foot) will be retained by the laboratory and may be analyzed later, if explosives are detected in the 8-10 foot sample.

AOC 7: J-3 Demolition Area: Due to the nature of activities conducted within the unlined demolition pit, the area is considered a potential release area for explosives, petroleum products (diesel fuel), and metals. Because the demolition pit is unlined and rainwater collects there, a potential for explosives and other residuals to be present in the subsurface exists. Four soil borings will be advanced in this area to a depth of 16 feet bgs (Figure 3-4). From each boring, a soil sample collected from the 2-4, 6-8 and 10-12 foot depth intervals will be submitted to the laboratory for potential explosives and EPH analysis. It is anticipated that initially only the 2- 4 foot sample grade will be analyzed for explosives and EPH. Deeper soil samples will be retained by the laboratory and may be analyzed later, if explosives are detected in the 2-4 foot sample.

AOC 10: J-1 Range Suspected Process Water Disposal Area: Similar to the Loading Building, subsurface soil sampling will be undertaken at this AOC to evaluate the presence of explosives in subsurface soils potentially resulting from the reported discharge of 1,200 gallons of process water, as previously described. This characterization will only be undertaken if explosives are detected in surface soils. If detected, one boring will be advanced at the location of the highest surface soil detection of explosives. The boring will be sampled continuously to a depth of 16 feet bgs. Samples from the 2-4, 6-8 10-12 and 14-16 foot depth intervals will be submitted to the laboratory for potential explosives analysis. It is anticipated that initially only the 2- 4 foot sample will be analyzed for explosives. Deeper soil samples

will be retained by the laboratory and may be analyzed later, if explosives are detected in the 2-4 foot sample.

3.7.2 Soil Boring and Sample Collection Methods

Soil samples will be collected continuously from the surface to an approximate depth of 16 feet bgs using direct push methods and dedicated plastic sleeves. An HLA geologist will oversee the soil boring process, log soil samples collected during drilling, and note soil textures, other visual observations, odors, PID meter readings, stratigraphy and depth to groundwater at each location. Soil comprising the 2-foot sampling interval will be composited prior to being placed in sample jars. Samples to be analyzed for VOCs will not be composited. To minimize the potential for cross-contamination, sampling equipment will be decontaminated after sample collection.

Samples will be retrieved using the following procedure:

1. Scan the soil with a PID and record the reading. Note the physical characteristics of the soil, including soil classification nomenclature (Unified Soil Classification System), color, particle size, moisture content, and staining or odors (if present).

2. For VOC headspace screening, fill an 8-ounce reference jar halfway, cover the mouth with aluminum foil, and cap the jar.

3. If sample may be submitted for off-site analysis, place the sample soil in the containers (using a clean stainless steel spatula) in the following order: (a) Fill the methanol-preserved VOC jars first, avoiding mixing or disturbing the natural packing. (b) Place the 2-foot interval sample material in a clean stainless steel bowl (c) thoroughly homogenize the soil sample. Containers for shipment to the laboratory will be filled from the temporary container following compositing and homogenizing of the 2-foot sample interval.

4. Decontaminate the sampling device according to the procedure outlined in Subsection 3.10.

Soil sampling data will be recorded on a Soil Boring Log (Figure 3-7) for each boring. Upon completion, the borehole will be backfilled with the soil cuttings and its location flagged. Excess soil cuttings will be drummed with new DOT drums provided by the drilling contractor pending laboratory characterization (see Section 6.0). All probe equipment will be decontaminated between and after the advancement of each probe using an Alconox/water (or similar) solution and clean water rinse.

3.8 Crushed Drum Excavation, Removal and Soil Sampling

HLA will oversee the excavation and removal of the estimated 27 55-gallon drums at AOC 11. The drums were reportedly crushed and buried below an earthen mound on the J-3 Range after being emptied of process water on the J-1 Range (AOC 10). The excavation will be accomplished by the UXO contractor using a backhoe under the oversight of HLA. The drums will be excavated and temporarily stored on site pending disposal characterization. Once the soils from below the drums are exposed, soil samples will be collected and characterized in accordance with the procedures described in Section 3.5.2.

HLA anticipates that a total of four soil samples will be collected from below the drums for laboratory explosives analysis (Figure 3-4).

3.9 WELL INSTALLATION AND GROUNDWATER SAMPLING

Groundwater well installation and sampling will be conducted to assess the potential for groundwater contamination by explosives residuals as a result of TSC activities on the Ranges. The following subsections discuss the rationale for sample collection, analysis, and quality control. The Phase II sampling analytical program is summarized in Table 3-3, and well locations are shown on Figure 3-1 and 3-5.

3.9.1 Well Locations and Depth

AOC 1 Loading Building: Groundwater sampling will be undertaken to evaluate the potential presence of explosives in groundwater resulting from the reported discharge of process water from the holding tank to the ground surface 100 feet southwest Loading Building. Three 1-inch diameter steel SDDWs (to be identified as J3DW-01 through J3DW-03) will be installed at the process water discharge area (Figure 3-1). Two wells will be installed downgradient of the suspected discharge area and one upgradient. A fourth optional well will be installed if explosive residuals are found in soils at the suspected disposal area. Based on an assumed depth to groundwater of 30 feet below grade in this area, HLA has estimated the total depth of each well will be 40 feet bgs.

AOC 10: J-1 Range Suspected Process Water Disposal Area: Similar to the Loading Building, groundwater sampling will be undertaken at this AOC to evaluate the presence of explosives in groundwater potentially resulting from the reported discharge of process water into an existing depression at the 1,000-meter range target area. Three 1-inch diameter steel SDDWs (to be identified as J1DW-01 through J1DW-03) will be installed at the process water discharge area (Figure 3-5). Two wells will be installed downgradient of the suspected release area and one upgradient. A fourth optional well will be installed if explosive residuals are found in soils at the suspected release area. Based on an assumed depth to groundwater of 100 feet below grade in this area, HLA has estimated the total depth of each well will be 110 feet bgs.

3.9.2 Monitoring Well Installation

The SDDWs will be installed using a direct-push/vibratory boring techniques. It is anticipated that the SDDW's will be installed to depths of 40 and 110 feet respectively on the J-3 and J-1 Ranges. The SDDWs will consist of a 1 inch diameter steel screen and riser pipe. Well screens will be 10 feet in length and will be placed to intersect the water table. A HLA geologist will be present during the installation of the SDDWs and will record the details of well construction on a Monitoring Well Construction Diagram (Figure 3-8).

3.9.3 Monitoring Well Purging and Groundwater Sampling

Prior to sampling, HLA will purge each well of a volume of water equivalent to three times the standing water volume. Wells will be purged using an inertial pump and disposable polyethylene tubing, as described below. HLA will initiate the groundwater sampling following purging and water level

measurement. Groundwater samples will be collected from each well using an inertial pump and disposable polyethylene tubing, and will be analyzed for explosives. Purging and sampling will be conducted using the following procedure.

1. Measure and record the distance between the top of the well riser cap and the top edge of the uncapped protective casing.

2. Using an electronic water level meter, measure and record on the sampling log the static water level in the well and the depth to the well bottom to the nearest 0.01-foot. Upon removing the water level wire, rinse with Liquinox/water and then rinse with deionized water.

   Note: If non-aqueous phase liquid is present in the monitoring well, stop work and contact HLA Task Manager.

3. Calculate the volume of standing water in the well.

4. Lower the sampling tubing into the well until the tube intake is at the midpoint of the saturated portion of the well screen and begin purging.

5. Using a Horiba U-10 combination meter measure the *in-situ* temperature, pH, dissolved oxygen, turbidity, and specific conductance. Redox potential will also be monitored using an Orion meter.

6. Monitor the *in-situ* parameters and measure the volume of groundwater being pumped. Record the *in-situ* parameters on the sampling log (Figure 3-9). Purging of the standing well water is considered complete when three times the standing volume in the well has been removed.

7. Temporarily store water generated during purging and sampling in a 5-gallon container. Following sampling, transfer the purge water to a U.S. Department of Transportation-approved, 55-gallon drum.

8. Upon completion of purging, collect the groundwater samples directly from the pump discharge tubing into pre-labeled sample containers. The samples shall be unfiltered. Latex or vinyl gloves will be worn during purging and sample collection.

9. Complete the Groundwater Sampling Form (Figure 3-9) as each well is sampled.

10. Secure the well cap and lock the protective casing.

Groundwater sampling data will be recorded on a Groundwater Sampling Form (Figure 3-9) for each well sampled. The temperature, specific conductance, pH, redox potential, dissolved oxygen, and turbidity of each sample will be measured at least three times during the pre-sampling purge and recorded on the Field Data Record along with other sample-specific information. Entries will be in permanent blue or black ink. Blank spaces on the log form are unacceptable; if the information required is not applicable, the space will be marked "N/A".

Stabilized groundwater levels will be measured in all newly installed wells and additional on-site well as access permits. These measurements will be collected no less than 24 hours after groundwater sampling to ensure that all wells have fully recharged.

3.10 DECONTAMINATION PROCEDURES

The following methods of decontamination will be implemented to prevent cross-contamination between sampling points and exploration locations.

Non-disposable sampling equipment items such as stainless steel spoons and bowls/buckets will be decontaminated by HLA field personnel prior to use and after collection of each sample. Whenever possible, disposable items will be used.

The decontamination process will include washing the sampling device using a scrub brush and a Liquinox® and potable water solution, followed by a potable water rinse and a deionized water rinse. If visual or olfactory evidence of hydrocarbon contamination is observed on the split spoon sampler, a methanol rinse will be added prior to the final deionized water rinse. To minimize the use of methanol, if gross hydrocarbon contamination is observed on stainless steel sampling spatulas after use, they will be discarded rather than re-used. The methanol decontamination fluid, if used, will be containerized as investigation-derived waste (IDW). IDW management is discussed in Section 6.0. Full sample containers will be wiped clean at the sample site, transferred to a clean carrier, and transported to the sample handling area.

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instrument as possible with plastic without hindering the operation of the unit. The PID may be placed in a clear plastic bag, keeping the sensor tip and discharge port clear, to allow reading of the scale and operation of the knobs.

Protective coverings that are used and stained with hydrocarbons will be drummed with other disposable protective materials as IDW. On a daily basis, any direct or obvious contamination on the instrument will be brushed or wiped with a disposable paper wipe. The units can then be wiped off as usual with damp disposable wipes, and dried. Monitoring equipment will be checked, calibrated, and recharged as necessary for the next day's operation, and will then be prepared with new protective coverings.

3.11 ANALYTICAL PROGRAM

Samples will be analyzed using USEPA SW-846 Methods (USEPA, 1996a). Explosive compounds analysis will be performed in accordance with EPA Method 8330 and will include Photo Diode Array (PDA) confirmation of detected compounds. In addition, the standard EPA Method 8330 parameter list will be modified to include the following: 2,6-diamino-4-nitrotoluene, 2,4-diamino-6-nitrotoluene, nitroglycerin, pentaerythritol tetranitrate, and ammonium 2,4,6-trinitrophenoxide/2,4,6-trinitrophenol. Metals analysis will consist of the 13 Priority Pollutants analyzed using SW-846 methods, 6000/7000 series. Massachusetts Department of Environmental Protection (MADEP) EPH analysis with target SVOCs will be performed on select samples. HLA will use a PID to screen all samples for total VOCs in jar headspace. HLA does not anticipate that VOCs will be present. However, if VOCs are measured in headspace screening samples, samples will be analyzed for either VOCs or volatile petroleum

hydrocarbons (VPH) by the MADEP method, as appropriate. Table 3-3 provides a summary of the sampling and analysis program. Analytical methods and reporting limits are summarized on Table 3-4 and Table 3-5. In addition, quality assurance and quality control (QA/QC) samples will be collected as discussed below.

3.11.1 QA/QC and Blank Samples and Frequency

QA/QC samples to be collected during the soil and groundwater sampling program include duplicate, matrix spike/matrix spike duplicate (MS/MSD), equipment rinsate blank samples and trip blanks. Duplicate samples will be taken at a frequency of one per every 10 field samples, and MS/MSD samples will be collected at a frequency of one per every 20 field samples. If collected, all of the VOCs samples will be shipped together in a single cooler so that only one trip blank need be submitted for VOCs analysis. Four equipment rinsate blanks will be collected. The QA/QC objectives are presented on Tables 3-5 through 3-9.

3.11.2 Sample Containers and Preservation Techniques

The sample containers proposed for use are as follows:

- Teflon© septum-sealed, wide-mouth, glass jars or glass vials for VOCs
- Glass jars with Teflon©-lined lids for all other parameters
- Teflon© septum-sealed glass vials for groundwater samples analyzed for VOCs

Sample bottles are prepared in accordance with the procedures specified as USEPA Level I QA for sample containers. This includes washing according to USEPA protocols, QC analysis of washed containers, custody sealing of containers prior to shipment, and full documentation of QC analytical results.

The bottles for the field program will be pre-prepared and provided by the HLA contract laboratory. Where preservatives are required, pre-preserved sample jars/bottles will be provided. The QA sample containers will be from the same source and provided by the HLA contract laboratory. A summary of specific containers, sample volume, preservation, and holding time requirements is provided, by analysis, in Table 3-10. Sample identification and tracking field procedures are described in Section 5.0.

3.11.3 Field Quality Control Sampling Procedures

Whenever possible, duplicate samples shall be taken from locations exhibiting high VOC headspace readings, and matrix spike samples shall be taken from locations suspected to exhibit low levels of contamination. For each analysis, no more than one QC duplicate sample shall be taken from each field location. Multiple duplicates for a particular analysis should not come from the same location. With the exception of samples to be collected for VOCs analysis, QC/QA samples shall be composited with the field sample from a particular sample location.

For soil samples, field blanks will include trip blanks and equipment rinsate blanks. Trip blanks will consist of organic-free water, and will accompany the soil sample containers. Trip blanks will be analyzed for VOCs only.

For aqueous samples, field blanks will include trip blanks and equipment rinsate blanks. The trip blank will consist of organic-free water that will accompany the soil sample containers when VOC analysis is to be performed.

3.12 Data Validation and Management

Analytical data obtained from the subcontract laboratory will be organized into a working set and validated by the LSC. An assessment of data quality will be presented in the Phase II report including interpretations on data usability.

3.12.1 Analytical Data Quality Objectives

Data quality objectives (DQOs) are quantitative or qualitative statements developed by the data user to specify the quality needed from a particular data collection activity to support specific decisions. The DQOs for this project are to provide analytical data of known quality and to be able to defend the quality of the data generated from the samples. The data from the analysis of field samples are to be used to characterize the material in terms of target compounds and physical characteristics.

Data quality is assessed in terms of accuracy, precision, detection limits, completeness, representativeness, and comparability, as discussed below. Quality control measures, objectives, and detection limits for analytical procedures that will be used for this project are presented in Table 3-5 through 3-9.

Accuracy is defined as the degree to which the analytical measurement reflects the true concentration level present. Accuracy will be measured by percent recovery for laboratory control samples and matrix spikes as the primary criteria, and percent recovery of the surrogate spikes as a secondary QC criterion.

Precision is a measure of the agreement among individual measurements of the same parameter under similar conditions, expressed as relative percent difference (RPD). The RPD of all laboratory duplicates will be reported by the laboratory. Precision will be assessed by reviewing QC information from the matrix spikes, field duplicates, blank spike/duplicates, and lab replicates.

Detection limits are defined as quanititation limit goals for each analyte. Quantiation limits establish a lower concentration value where accurate data should be obtained for the given method and target analyte. Quantiation limits are established based on instrument calibration curves and instrument or method detection limit (MDL) studies. (Procedures for determining detection limits are those given in 40 CFR CH.1 (7-1-85) Pt 136 App. B).

Completeness is a measure of the amount of valid data obtained from the analytical measurement system, expressed as a percentage of the number of valid measurements that should have been or were planned to be collected. The QA objective for this project is to obtain acceptable data for 90 percent of the samples collected. Completeness will be evaluated by comparing stated project objectives with the validated data

results, and identifying shortfalls, if any, in needed information.

Representativeness is defined as the degree to which the data accurately and precisely represent the true environmental contamination existing at the site. Representativeness of samples will be achieved to the greatest degree possible by adhering to the procedures specified in this document. Representativeness is also evaluated through collection and analysis of field duplicate samples, rinsate blanks, and trip blanks.

Comparability expresses the confidence with which one set of data can be compared with another. Quantitatively, comparability can be assessed in terms of the precision and accuracy of two sets of data. The use of standard analytical methods, standard reporting units and thorough documentation will achieve this objective.

3.12.2 Data Validation

Data validation will be completed on all data generated at the off-site laboratory. Validation will be completed using USEPA Region I validation guidelines for Tier II and Tier III validation (USEPA, 1996b; USEPA, 1989). Tier III validation will be completed on 10 percent of the samples. Tier II validation will be completed on the remaining samples. For explosives data generated using USEPA Method 8330, the general processes outlined in the USEPA Region I guidelines will be followed with professional judgement used when evaluating Method 8330 analytical protocols and laboratory performance. Data generated by Massachusetts VPH and EPH methodologies will be reviewed using data quality goals specified in the published methods and general data validation procedures for organics analyses from the USEPA Region I guidelines. HLA data validation procedures for EPH and VPH are provided in Appendix A and B respectively.

Hard copy data deliverables will be obtained from the subcontract laboratory to provide documentation of sample analyses. The laboratory deliverable packages will contain forms summarizing sample results and all associated raw data generated in support of the reported results. Results of the QC measurements including calibration data, laboratory control data, matrix spike/matrix spike duplicate data, surrogate recovery, laboratory duplicate summaries, associated QC blank summaries, and internal standard summaries will be provided on forms similar to the USEPA CLP reporting requirements summarizing all QC measurements that are applicable to the USEPA SW846 method. Raw data will include copies of all associated instrument printouts and laboratory notebook records that were generated during the sample preparation and analysis. The data validation process will include project chemist reviews of the following items:

A. Review of chain-of-custody (COC) documents to verify sample identities.

B. Review of sample log-in documents to verify any problems with custody seals, container integrity, sample preservation, labeling, etc.

C. Review of field rinsate blank data to ascertain any potential problems with container contamination, sampling equipment contamination, or cross contamination between samples during transport.

D. Review of trip blank data to identify any potential problems with sample container

contamination, preservative contamination, laboratory reagent water contamination, or cross contamination between samples during transport

E. Review of method blank data to determine the presence of any sources of contamination in the analytical process.

F. Review the MS data to evaluate the potential for matrix effects and as a measure of analytical accuracy. MS recoveries will be compared against laboratory and project specified acceptance criteria to determine if they are within or outside of control limits for percent recoveries.

G. Review of MS/MSD data to evaluate sample homogeneity and as a measure of analytical precision. MS/MSD data will be compared against laboratory and project specified acceptance criteria for the maximum RPD.

H. Review of blank spike (BS) data as a measure of analytical accuracy. BS recoveries will be compared against laboratory and project specified acceptance criteria to determine if they are within or outside of control limits for percent recoveries.

I. Review of blank spike and blank spike duplicate (BS/BSD) data (if available) as a measure of analytical precision. BS/BSD data will be compared to laboratory and project specified acceptance criteria for the maximum RPD.

J. Review of sample and field duplicate data as a measure of sample homogeneity and as a measure of analytical precision. Sample and field duplicate data will be compared against the USEPA regional acceptance criteria for the maximum RPD.

K. Review of surrogate recovery data to access extraction efficiency, effectiveness of sample introduction, and possible loss during cleanup activities. Surrogate recoveries will be compared to laboratory generated and project specified acceptance criteria to determine if they are within or outside of acceptable limits.

L. Review of sample dates, extraction/digestion dates, and analysis dates to determine if maximum holding times were met or exceeded.

Data qualifiers may be added to the final analytical results as indicators of data quality and usability. Data qualifiers will be added in accordance with USEPA Region I data validation guidelines for organic methods (USEPA, 1996b). Professional judgements may be made on the qualification of data. Professional judgements will be described on validation documentation records, and validation reports provided in the Phase II ESA report.

4.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

The following is a summary of the requirements for recording and documenting the conditions of the field investigation and all pertinent data. Emphasis is placed on sample designation and documentation procedures that will be followed during sample collection to ensure that samples collected during the field program can be easily tracked. Field personnel involved in the investigation program will be trained and aware of these procedures prior to implementation of the field investigation.

Forms will be completed in permanent blue or black ink. Errors will be corrected by crossing out with a single line and dating and initialing the change. The use of correction fluid is not permissible. The field forms generated during the investigation will remain on site during the entire effort. Forms used will be kept organized in a central file maintained in the field vehicle until completion of the field program.

4.1 LOGBOOKS

Logbooks will be maintained throughout the field investigation. The site master log, field logbooks, and field equipment logbook are briefly described below.

4.1.1 Site Master Log

The site master log is the primary field investigation document to be maintained by the FOL. Its primary purpose is to contain, within one document, the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day. Any administrative occurrences, conditions, or activities that have affected the fieldwork will also be recorded.

4.1.2 Field Books

Separate field books, as necessary, are typically maintained by each field team responsible for sampling and support activities. However, because only one sampling team will operate at any given time on this project, the site master log will also serve as the field book. Field books will be sequentially numbered by the user and bound with a hard cover. Entries will be in permanent blue or black ink with changes initialed and dated. In general, these books will contain specific details supporting the tasks performed by the person maintaining the field logbook, including monitoring instrument readings. Supporting field data forms will also be filled out for soil boring explorations (Figure 3-7), monitoring well construction (Figure 3-8), water level data (logbook), and groundwater sampling (Figure 3-9). The following is a partial list of the types of information to be recorded in the field books or on supporting field data forms:

- name and title of author, date and time of entry, and physical/ environmental conditions during the field activity
- name and titles of field crew, including subcontractors
- names and titles of all visitors
- documentation of health and safety activities
- purpose of sampling activity

- type of sampled media (i.e., soil, groundwater)
- sample collection method (i.e., grab or composite)
- number and volume of samples taken
- description of sampling points
- date and time of collection
- sample identification numbers
- references for all maps and photographs of the sampling sites
- field observations
- field measurements made (i.e., pH, temperature)
- decontamination procedures
- instrument calibration

4.1.3 Field Equipment Notebook

The purpose of the field equipment notebook is to document the proper use, maintenance, and calibration of the field testing equipment. Equipment will be inspected and approved by the FOL before being used. A Calibration Data Sheet (Figure 3-6) will be maintained daily for all monitoring instruments used on site; the bound data sheets will comprise the Field Equipment Notebook. Information recorded on the data sheets or on separate pages in the notebook will include the following items:

- name and identifying number of the instrument
- date calibrated
- calibration points
- identification of the calibrator
- manufacturer
- lot number of calibration standards
- expiration date of calibration standards
- results of the calibration
- field maintenance
- problems encountered/resolution of problems

4.2 PHOTOGRAPHS

Field personnel may take photographs during the field investigation to aid in documentation of field activities, site conditions, and/or sample characteristics. A written description of the photographs will be recorded in the field logbook. Developed and/or undeveloped film will be maintained in the project file. No motion pictures/videography are planned for this investigation.

4.3 SAMPLE NUMBERING SYSTEM

Samples collected during the investigation will be identified using a 12-digit numbering system, as described below:

Digits 1 & 2	Site Designation J1 – J-1 Range J3 – J-3 Range
Digits 3 & 4	Sample Type SB – Soil boring soil sample DW – Groundwater sample from SDDW QT – Trip blank QS – Rinsate blank SD - Sediment/Sludge sample SS - Surface soil sample
Digits 5, 6	Horizontal Sample Locator – indicates the exploration location number (e.g., 02, 03).
Digits 7, 8	Vertical Sample Locator – indicates the *top* of the sample depth interval. For example, a soil sample collected from 4 to 6 feet bgs would be given the designation "04". In the case of groundwater samples, these two characters are designated "XX" as a placeholder.
Digits 9, 10	Used as sampling event numbers when more than one round of sampling is required. For example: 01 – indicates Round 1 02 – indicates Round 2
Digits 11, 12	Modifiers XX – Regular field sample XD – Duplicate sample (to contract laboratory) XS – Matrix Spike XM – Matrix Spike Duplicate

For example, a duplicate groundwater sample collected from SDDW DW-4 during sampling round one would have an identification number of:

J1DW04XX01XD

Samples collected for laboratory analysis will be handled according to HLA's standard procedures outlined in this Section.

4.4 SAMPLE DOCUMENTATION

4.4.1 Sample Labels

Samples obtained at the site for off-site analysis will be placed in appropriate sample containers for shipment to the laboratory. Each sample bottle will be identified with a separate identification label. Labeling will be printed in indelible/waterproof ink. Entry errors will be crossed out with a single line, dated, and initialed. Each securely affixed label will include the following information:

- project identification
- sample identification number
- sampling personnel
- preservatives added
- date and time of collection
- analytical method

4.4.2 Chain of Custody Records

COC will be maintained throughout the duration of sample collection, shipment, storage, and analysis, as a legal record of sample possession. Possession will be traceable by means of a COC Record (Figure 4-1), which remains with the samples at all times and bears the signatures of the persons responsible for possession of the samples. Procedures for maintaining appropriate sample custody information are presented in the following Subsections.

4.4.2.1 Sample Custody

HLA has established a program of sample custody that is followed during sample handling activities from the field through laboratory operations. This program is designed to assure that each sample is accounted for at all times. To maintain this level of sample custody, computer-generated sample container labels and overnight carrier shipping manifests are normally employed.

Field Data Records (Figures 3-6 through 3-9) and COC Records (Figure 4-1) will also be completed by the appropriate sampling and laboratory personnel for each sample.

The objective of the HLA sample custody identification and control system is to assure, to the extent practicable, that the following conditions are met:

- samples scheduled for collection are uniquely identified;
- the correct samples are analyzed and are traceable to their records;
- important sample characteristics are preserved;
- samples are protected from loss or damage;
- any alteration of samples (e.g., filtration, preservation) is documented;

- a forensic record of sample integrity is established; and
- client confidentiality is maintained.

The COC protocol followed by the sampling crews involves the following activities:

- documenting procedures and amounts of reagents or supplies (e.g., filters) which become an integral part of the sample from sample preparation and preservation;
- recording sampling locations, sample bottle identification, and specific sample acquisition measures on the appropriate forms;
- using the prepared sample labels (whenever possible) to document all information necessary for effective sample tracking; and
- completing standard field data record forms to establish sample custody in the field before sample shipment.

Prepared labels will be numbered to correspond with each unique sample to be collected.

The COC record is used to document the following information:

- sample handling procedures, including sample location, sample number, and number of containers corresponding to each sample number;
- the sample including sample matrix, container types, and preservation techniques; and
- the COC process.

The COC description section requires the following information:

- the sample number and sample bottle identification number, where applicable;
- the names of the sampler(s) and the person shipping the samples;
- the date and time that the samples were collected;
- the date and time that the samples were delivered for shipping;
- the names of those responsible for receiving the samples at the laboratory; and
- Any other pertinent information relating to the sample or sampling process.

A sample COC Record is shown in Figure 4-1. The COC record is completed in quadruplicate. Two copies accompany the samples to the laboratory, another is kept by the sample crew chief and transferred to the FOL, and the last copy is maintained in the project file. Additional copies can be provided if needed for the project. Chain of custody is also assured by the use of custody seals on sample shipments.

6.0 INVESTIGATION DERIVED WASTES

As part of the field activities, solid and liquid IDW may be generated in association with personal protective equipment, decontamination, screening sample preparation and handling, drilling, and groundwater purging activities. Every effort will be taken to minimize the amount of IDW. Each material type (e.g., soil, groundwater) will be drummed separately. The majority of these materials will be uncontaminated, but some IDW potentially will have had contact with contaminated media.

Soil generated during the drilling program (expected to be minimal because of the use of direct-push drilling) will be containerized in U.S. Department of Transportation-approved, 55-gallon drums for pending disposal characterization. Well purge water, development water, and decontamination fluids generated during the field investigation will also be containerized in 55-gallon drums. HLA estimates that approximately two drums of soil cuttings and two drums of liquid will be filled during this field program.

Following the field investigation, HLA will contract a waste hauler to characterize the soil and groundwater for disposal using analytical data obtained during this field investigation. If analytical results indicate that the waste meets MADEP standards, the IDW may potentially be disposed on site. If results exceed MADEP standards, the contracted waste hauler will remove the drums from the site.

6.1 Waste Material Handling

Personal protective clothing (e.g., Tyvek, gloves), laboratory glassware, standards, and other disposable material which may come in contact with contaminated soil or water will be placed in a 55-gallon IDW drum. Containerized waste will be disposed of in accordance with all local, state, and federal regulations. The temporary staging location of the waste drums on site will be approved by the FOL.

6.2 Waste Drum Labeling

Drums will be labeled at the point of origin and will have labels attached at all times. Labeling information will include:

1. Facility name;
2. Contents (e.g., purge water or personal protective clothing);
3. Location where material was generated (e.g., J1DW01);
4. Date when filled;
5. PID meter headspace, and screening results in ppm; and
6. If IDW fails screening criteria, the label will also include the phrase "pending analysis".

Prior to off-site disposal, each drum label will also include the names of points of contact with telephone numbers. Points of contact will include the HLA Project Manager and a representative of the contracted waste hauler.

7.0 CORRECTIVE ACTIONS

Corrective or preventive action is required when potential or existing conditions are identified that may adversely impact data quantity or quality. Corrective action could be immediate or long term. In general, members of the program staff who identify a condition adversely affecting quality can initiate corrective action by notifying the FOL and HLA's Quality Assurance Coordinator (QAC) in writing. The written communication will identify the condition and explain how it may affect data quality or quantity.

7.1 IMMEDIATE CORRECTIVE ACTION

Immediate corrective action is usually applied to spontaneous, nonrecurring problems (e.g., instrument malfunction). The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, or methods, will immediately notify the FOL. The FOL will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the FOL must prepare a memorandum to the HLA Project and Task Managers. These individuals will collectively decide how to proceed. If the problem is limited in scope, the FOL will decide on the corrective action measure and document the solution in the field logbook

7.2 LONG-TERM CORRECTIVE ACTION

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. The QAC will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. The QAC will then file a corrective action request with the FOL and Project Manager. In case of dispute, the Corporate Officer will make a final determination for the company. If the corrective action will impact the project schedule, the TSC Project Manager will be notified.

Corrective actions may also be initiated as a result of other activities, including (1) performance audits; (2) system audits; (3) laboratory/field comparison studies; and (4) ongoing project audits.

The QAC will be responsible for documenting all notifications, recommendations, and final decisions. The Project Manager and the QAC will be jointly responsible for notifying project staff and implementing the agreed-upon course of action. The QAC will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as to not adversely affect either project schedules or subsequent data generation/processing activities. The QAC will also be responsible for developing and implementing routine program controls to minimize the need for corrective action.

Examples of long-term type of actions include:

- staff training in technical skills or in implementing the QA Program;
- rescheduling of laboratory routine to ensure analysis within allowed holding times;
- identifying vendors to supply reagents of sufficient purity; and

- revision of Contractor QA system or replacement of personnel.

For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

- define the problem;
- assign responsibility for investigating the problem;
- investigate and determine the cause of the problem;
- determine a corrective action to eliminate the problem;
- assign and accept responsibility for implementing the corrective action;
- establish effectiveness of the corrective action and implement the correction; and
- verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, corrective action employed, and verification that the problem has been eliminated will be documented.

8.0 PROJECT SCHEDULE

The schedule for the execution of the Phase II ESA field program is provided in Figure 8-1. Based the current scope of work the field investigation is anticipated to take nine weeks to complete including time for review and interpretation of laboratory reports. It is anticipated that the field program will begin on or about May 29, 2000.

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AOC	Area of Concern
ARRADCOM	U.S. Army Armament Research and Development
bgs	below ground surface
BS	blank spike
BSD	blank spike duplicate
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Procedure
COE-NAE	U.S. Army Corps of Engineers, New England District
COC	chain of custody
CSP	Certified Safety Professional
DOD	Command Department of Defense
DOT	Department of Transportation
DQOs	Data Quality Objectives
DU	depleted uranium
EFP	explosively formed projectile
EPH	Extractable Petroleum Hydrocarbons
ESA	Environmental Site Assessment
FOL	Field Operations Leader
HEAT	high-explosive anti-tank munitions
HLA	Harding Lawson Associates
HMX	Her Majesties Explosives
HSO	Health and Safety Officer
IDW	investigation-derived waste
LCS	laboratory control sample
LSC	Laboratory Services Coordinator
MAANG	Massachusetts Air National Guard
MAARNG	Massachusetts Army National Guard
MADEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MDL	method detection limit
mm	millimeter
MMR	Massachusetts Military Reservation
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
OHM	Oil or Hazardous Materials

PBX	plastic-bonded explosive
PDA	Photo Diode Array
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QAC	Quality Assurance Coordinator
QC	quality control
RECs	Recognized Environmental Conditions
RPD	relative percent difference
RDX	Royal Dutch Explosive
SDDW	small diameter driven wells
SAP	Sampling and Analysis Plan
SRM	standard reference manual
SVOC	semivolatile organic compound
TERA	Terminal Effects Research and Analysis
TNT	Trimitrotoluene
TSC	Textron Systems Corporation
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
VPH	volatile petroleum hydrocarbons
VOC	volatile organic compound

REFERENCES

ASTM E 1903-97 Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessments: Phase II Environmental Site Assessment Process.

Harding Lawson Associates, 2000. *Phase I ESA Report, Textron Systems Corporation, Camp Edwards, Massachusetts*, April 2000.

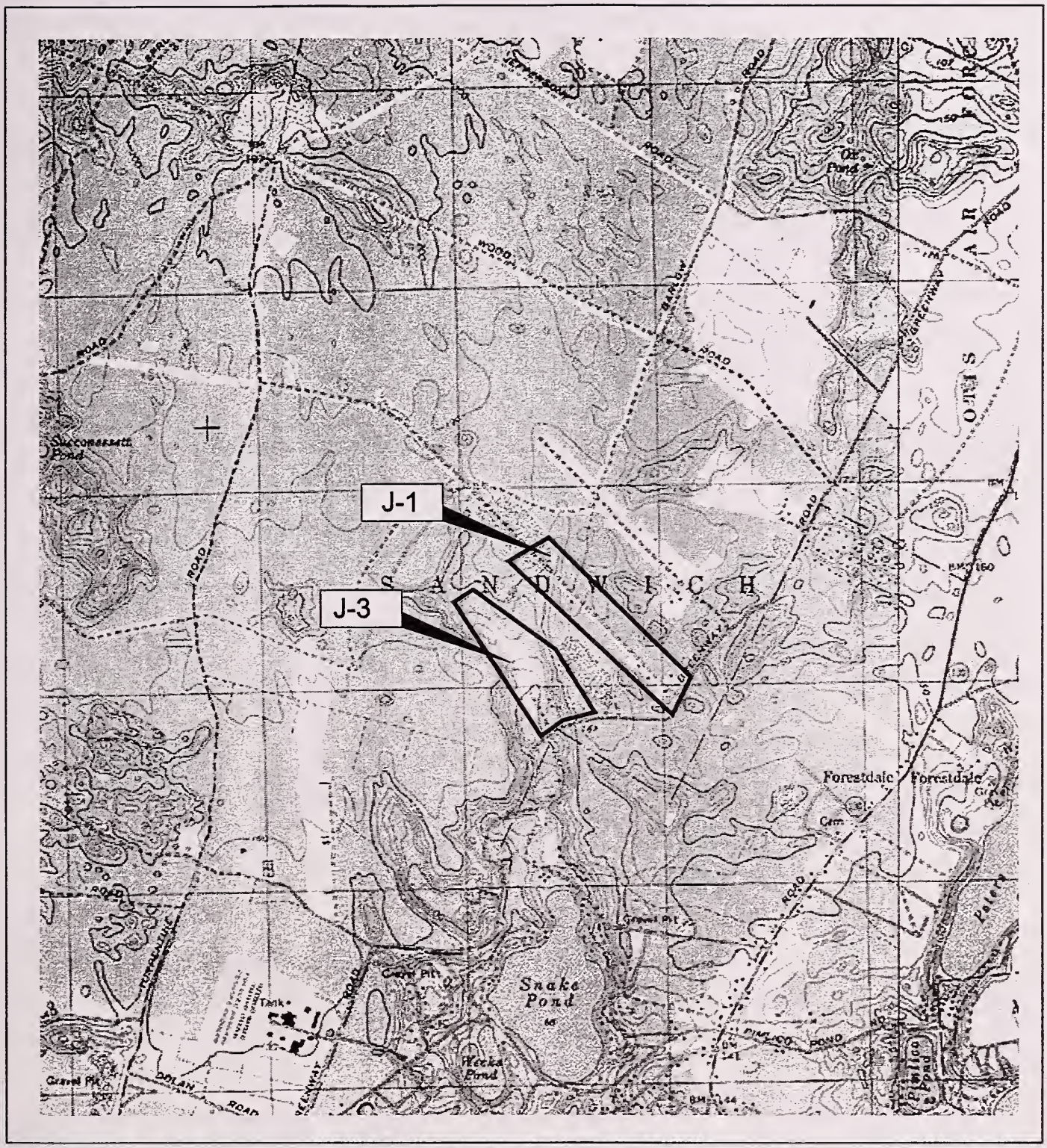
Massachusetts Military Division, 1996. Draft Environmental Impact Statement/Report for the Massachusetts Military Reservation Facilities Upgrade, November.

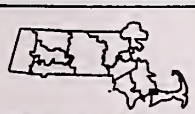
Ogden Environmental and Energy Services, 1998. Draft Completion of Work Report, Camp Edwards Impact Area Groundwater Quality Study. Massachusetts Military Reservation Cape Cod, Massachusetts, July, 1998.

U.S. Environmental Protection Agency (USEPA), 1989. "Region 1 Laboratory Data Validation Functional Guidelines For Evaluating Inorganic Analyses"; Hazardous Site Evaluation Division; February 1989.

U.S. Environmental Protection Agency, 1996a. "Test Methods for Evaluating Solid Waste"; Laboratory Manual Physical/Chemical Methods; Office of Solid Waste and Emergency Response; Washington, DC; SW-846; November 1986; Revision 4 –December 1996.

U.S. Environmental Protection Agency (USEPA), 1996b. "Region 1 EPA-NE Data Validation Guidelines For Evaluating Environmental Analyses"; Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December 1996





QUADRANGLE LOCATION
SOURCE: TOPO, 1998 WILDFLOWER PRODUCTIONS

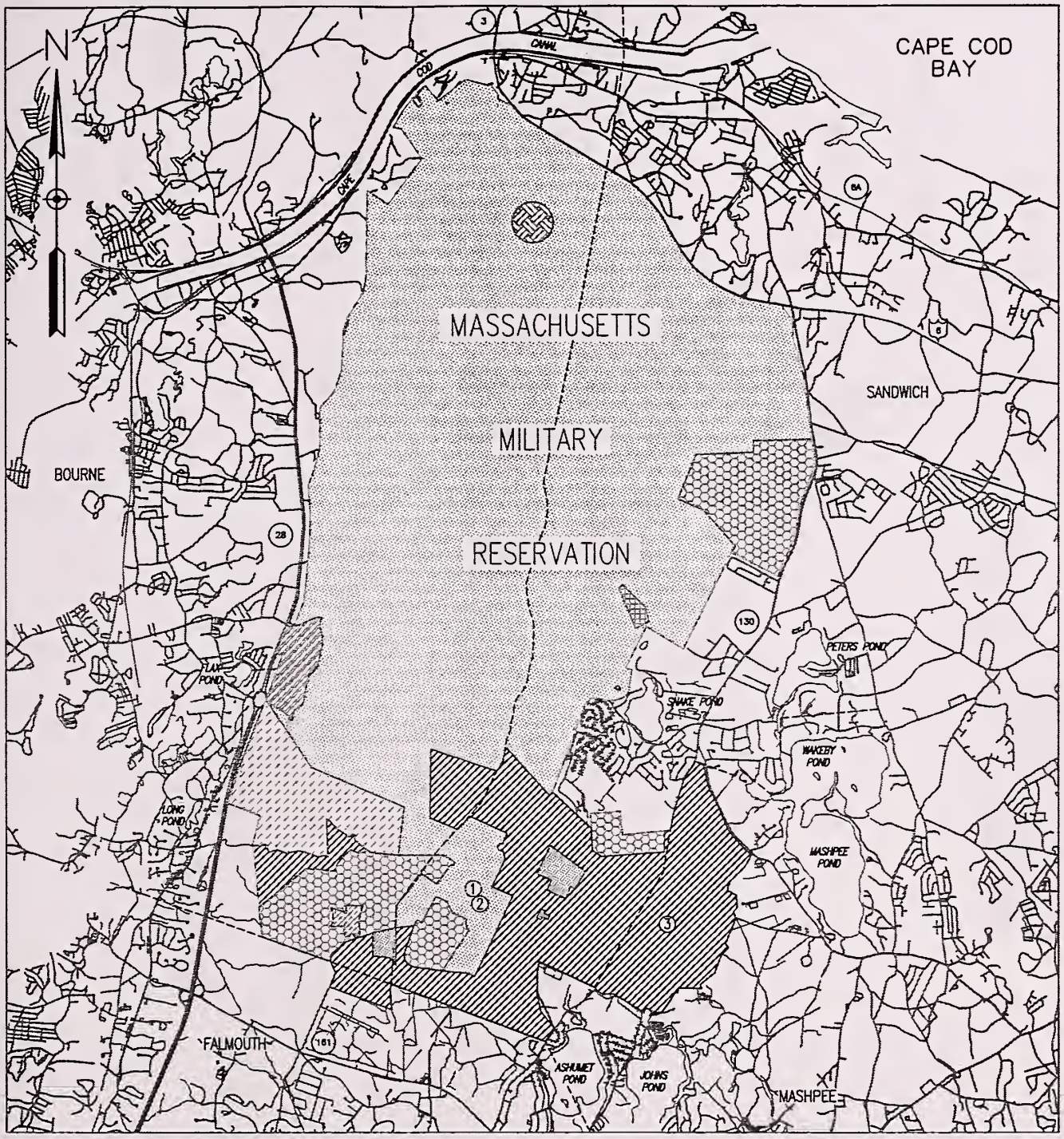
0 1/2 1 MILE
0 m 1000 m

N

Harding Lawson Associates

HLA

FIGURE 1-1
SITE LOCATION MAP
J-1 AND J-3 RANGES
CAMP EDWARDS, MASSACHUSETTS



LEGEND

- MAARNG – CAMP EDWARDS
- MAANG – OTIS ANGB
- U.S. COAST GUARD
- USAF – CAPE COD AFS (PAVE–PAWS)
- VA – NATIONAL CEMETERY
- TEXTRON CAPE OPERATIONS (J–3)
- BOURNE PUBLIC SCHOOLS
- OTIS ROD & GUN CLUB
- ① USDA
- ② USMC
- ③ FAA
- 6 6A US/STATE HIGHWAY

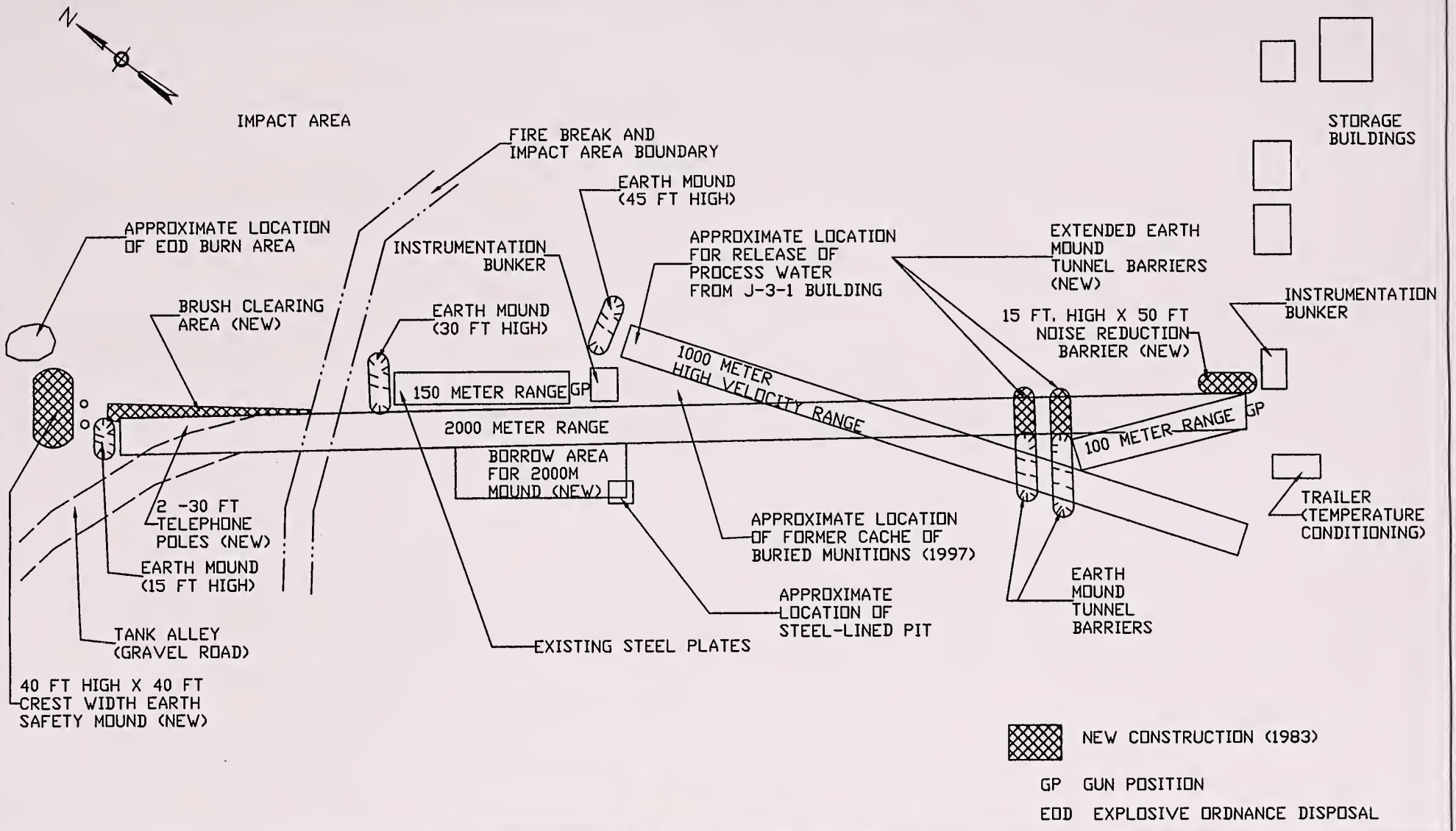
0 4000 8000 FEET

1"=8000'

Source: James M. Montgomery, 1991

SITE AREA

File Name: J:\6650-14\6650F027.DWG Figure 1-2



NOT TO SCALE

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J-1 RANGE SITE MAP
CAMP EDWARDS, MASSACHUSETTS

FIGURE
1-3

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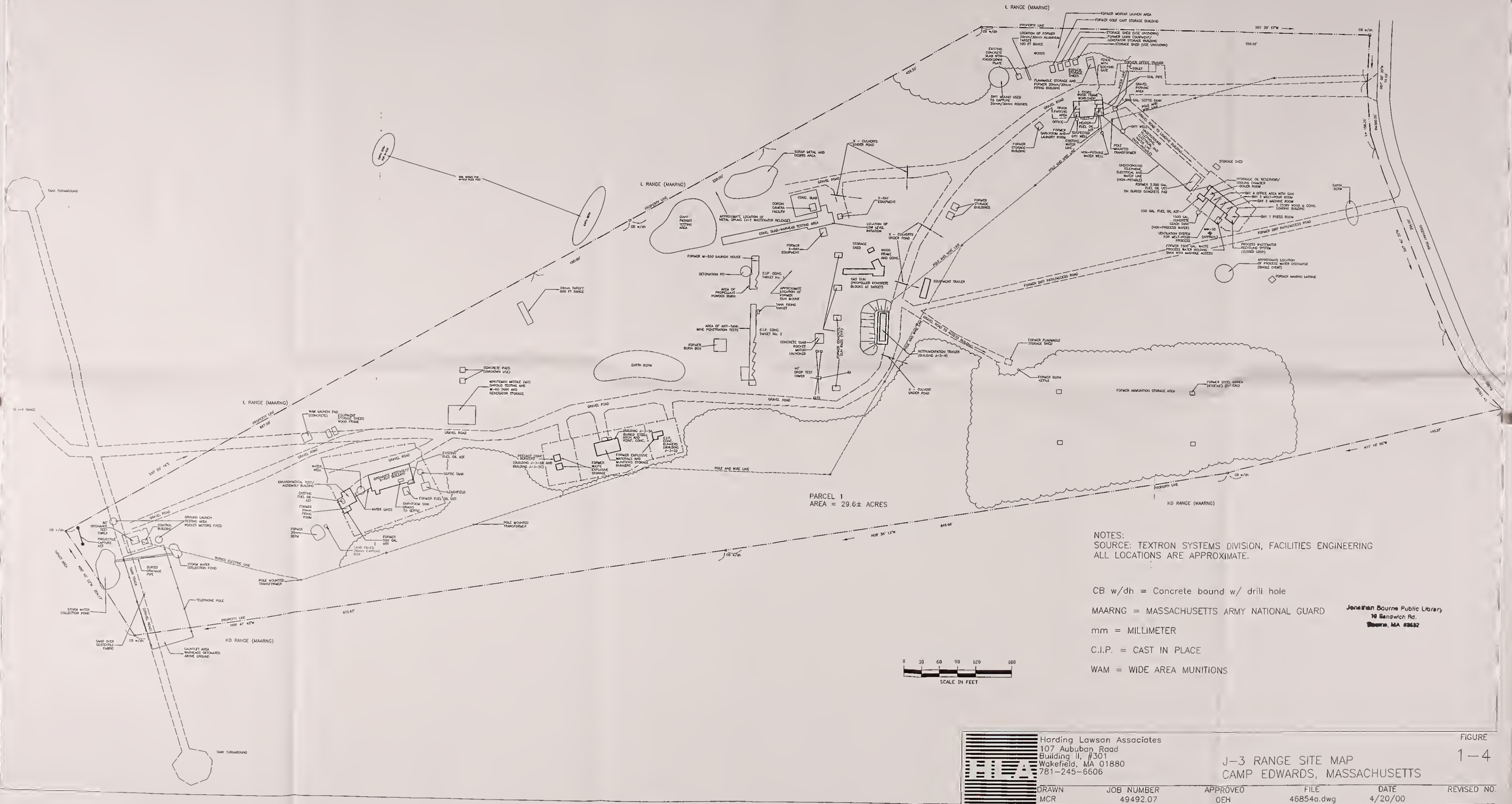
N
L RANGE (MAARNG)
PROPERTY LINE
CB w/dh
FORMER MORTAR LAUNCH AREA
FORMER GOLF CART STORAGE BUILDING
LOCATION OF FORMER 20mm/30mm ALUMINUM TARGET 100 FT RANGE
STORAGE SHED (USE UNKNOWN)
FORMER LAWN EQUIPMENT/ LOMOPATOR STORAGE BUILDING
STORAGE SHED (USE UNKNOWN)
WOODS
EXISTING CONCRETE GUARD BOOTH WITH KNOCK-DOWN PLATE
FENCE WITH SLIDING GATE
FORMER OFFICE TRAILER
TOILET
SOIL PIPE
DIRT MOUND USED TO CAPTURE 20mm/30mm ROUNDS
FLAMMABLE STORAGE AND FORMER 20mm/30mm FIRING BUILDING
GRAVEL PARKING AREA
1 STORY WOOD FRAME WORK SHOP
1000 GAL SEPTIC TANK
WELL AND WELL LINE
GRAVEL ROAD
TRUCK PARKING AREA
OFFICE
HEATED FUEL OIL DISPENSED DRY WELL
DRY WELL
FORMER DAY ROOM AND LAUNDRY ROOM
EXISTING WATER LINES
NON-POTABLE WATER WELL
FORMER STORAGE BUILDING
POLE MOUNTED TRANSFORMER
POLE AND WIRE LINE
UNDERGROUND TELEPHONE AND ELECTRIC LINE
WATER LINE (NON-POTABLE)
FORMER 2,000 GAL FUEL OIL VIT
ON BURIED CONCRETE PAD
STORAGE SHED
HYDRAULIC OIL RESERVOIR/ COOLING CHAMBER BOILER ROOM
BAY 4 OFFICE AREA WITH GSH
BAY 3 MELT-POUR ROOM
BAY 2 MACHINE ROOM
2 STORY WOOD & CONC. LOADING BUILDING
BAY 1 PRESS ROOM
550 GAL FUEL OIL AST
1500 GAL CONCRETE LEACH TANK (NON-PROCESS WATER)
VENTILATION SYSTEM FOR MELT-POUR PROCESS
FORMER 1500 GAL WASTE PROCESS WATER HOLDING TANK WITH MANHOLE ACCESS
FORMER DIRT PATH/ACCESS ROAD
PROCESS WASTEWATER RECYCLING SYSTEM (CLOSED LOOP)
APPROXIMATE LOCATION OF PROCESS WATER DISCHARGE (SINGLE EVENT)
FORMER MAARNG LATRINE
EARTH BERM
SCRAP METAL AND DEBRIS AREA
GIANT PATRIOT TESTING AREA
APPROXIMATE LOCATION OF METAL SPLAG (J-1 WASTEWATER RELEASE)
CONC. SLAB-MANHEAD TESTING AREA
CORDON CAMERA FACILITY
CONC. SLAB
X-RAY EQUIPMENT
LOCATION OF LOW LEVEL INITIATOR
X - CULVERTS UNDER ROAD
FORMER X-RAY EQUIPMENT
FORMER M-550 LAUNCH HOUSE
DETONATION PIT
C.I.P. CONC. TARGET No.
AREA OF PROPELLANT POWDER BURN
APPROXIMATE LOCATION OF FORMER GUN MOUNT
TANK FIRING TARGET
AREA OF ANTI-TANK MINE PENETRATION TESTS
C.I.P. CONC. TARGET No. 2
FORMER BURN BOX
CONCRETE SLAB-ROCKET MOTOR LAUNCHER
GAS GUN (PROPELLED CONCRETE BLOCKS AT TARGET)
STORAGE SHED
WOOD FRAME AND CONC.
EQUIPMENT TRAILER
40' DROP TEST TOWER
FORMER CONCRETE GAS TANK
INSTRUMENTATION TRAILER (BUILDING J-3-4)
FORMER FLAMMABLE STORAGE SHED
FORMER BURN KETTLE
FORMER AMMUNITION STORAGE AREA
FORMER STEEL CORNER (6'X3'X6') (DIT CAL)
CONCRETE PADS (UNKNOWN USE)
MINUTEMAN MISSILE (MX) SHROUD TESTING AND M-60 TANK AND GENERATOR STORAGE
EARTH BERM
WAM LAUNCH PAD (CONCRETE)
EQUIPMENT STORAGE SHEDS WOOD FRAME
GRAVEL ROAD
WATER WELL
EXISTING FUEL OIL AST
SEPTIC TANK
LEACHFIELD
EXISTING FUEL OIL AST
EXPLOSIVE ORDNANCE ASSEMBLY FACILITY BUILDING
EXPLOSIVE ORDNANCE TEST/ ASSEMBLY BUILDING
WATER LINES
FORMER 20mm BERM
FORMER 20mm FIRING ROOM
DEFLECTION SINK DRAINS TO SEPTIC
FORMER FUEL OIL VIT
FORMER 550 GAL VIT
SAND FILLED 20mm CAPTURE BERM
PRECAST CONC. BARRICADES (BUILDING J-3-5B AND BUILDING J-3-5C)
BUILDING J-3-5A BURIED STEEL ARCH AND REINF. CONC.
C.I.P. CONC. BUNKERS (BUILDING J-3-5)
FORMER EXPLOSIVE MATERIALS AND MUNITIONS STORAGE BUNKERS
FORMER EXPLOSIVE STORAGE
POLE AND WIRE LINE
PARCEL 1
AREA = 29.6± ACRES
KD RANGE (MAARNG)
80' ORDNANCE TEST TUNNEL
CONTROL BUILDING
GROUND LAUNCH TESTING AREA ROCKET MOTORS FIRED
PROJECTILE CAPTURE ACT
BURIED ELECTRIC LINE
STORM WATER COLLECTION POND
BURIED DRAINAGE PIPE
WAM TRACK
TELEPHONE POLE
STORM WATER COLLECTION POND
SAND OVER GEOTEXTILE FABRIC
GAUNTLET AREA WARHEADS DETONATED ABOVE GROUND
TANK TURNAROUND
0 30 60 90 120 180
SCALE IN FEET

NOTES:
SOURCE: TEXTRON SYSTEMS DIVISION, FACILITIES ENGINEERING
ALL LOCATIONS ARE APPROXIMATE.

CB w/dh = Concrete bound w/ drill hole

MAARNG = MASSACHUSETTS ARMY NATIONAL GUARD

mm = MILLIMETER

C.I.P. = CAST IN PLACE

WAM = WIDE AREA MUNITIONS

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J-3 RANGE SITE MAP
CAMP EDWARDS, MASSACHUSETTS

FIGURE 1-4

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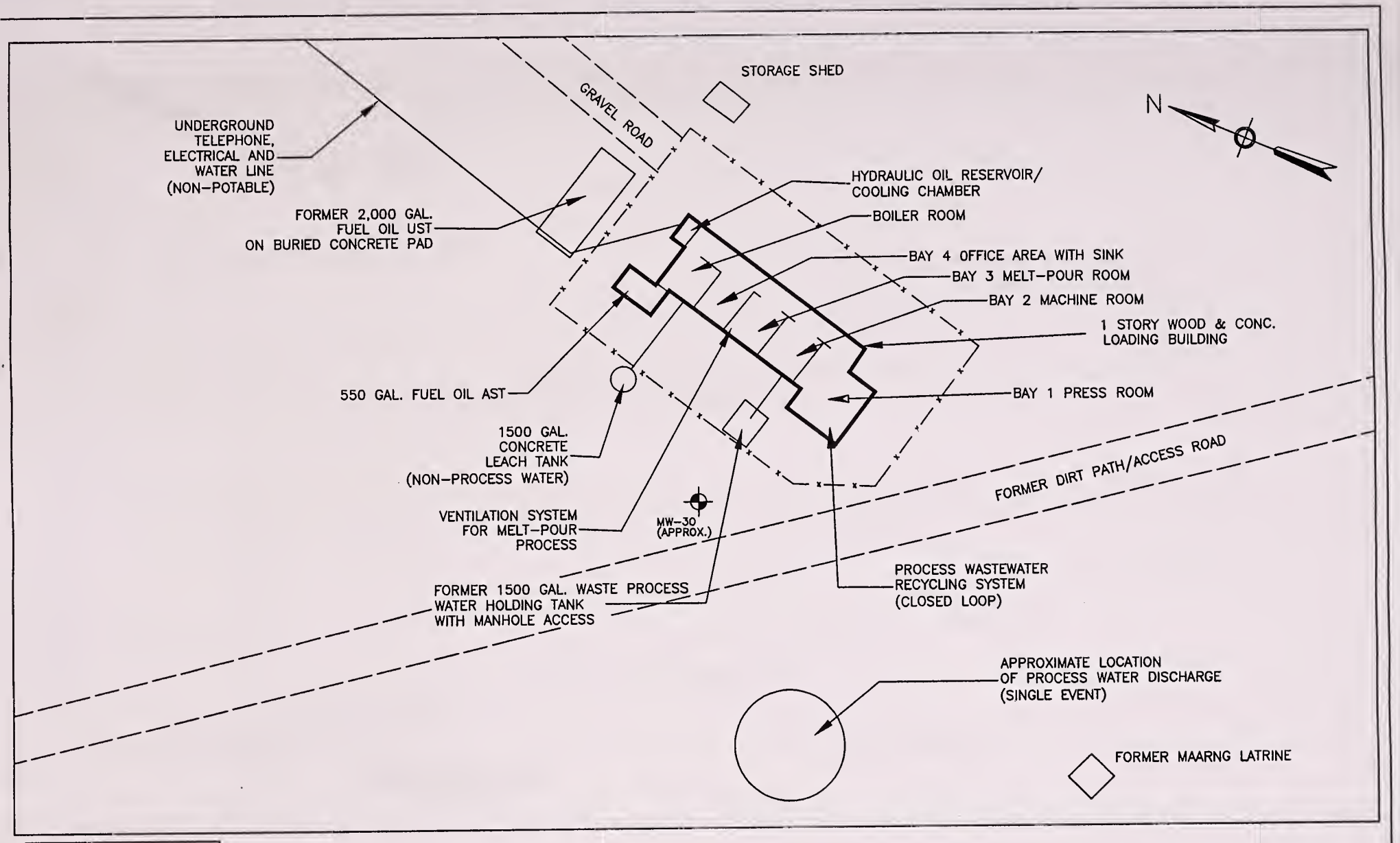
STORAGE SHED
GRAVEL ROAD
N
UNDERGROUND TELEPHONE, ELECTRICAL AND WATER LINE (NON-POTABLE)
HYDRAULIC OIL RESERVOIR/ COOLING CHAMBER
FORMER 2,000 GAL. FUEL OIL UST ON BURIED CONCRETE PAD
BOILER ROOM
BAY 4 OFFICE AREA WITH SINK
BAY 3 MELT-POUR ROOM
BAY 2 MACHINE ROOM
1 STORY WOOD & CONC. LOADING BUILDING
550 GAL. FUEL OIL AST
BAY 1 PRESS ROOM
1500 GAL. CONCRETE LEACH TANK (NON-PROCESS WATER)
FORMER DIRT PATH/ACCESS ROAD
VENTILATION SYSTEM FOR MELT-POUR PROCESS
MW-30 (APPROX.)
PROCESS WASTEWATER RECYCLING SYSTEM (CLOSED LOOP)
FORMER 1500 GAL. WASTE PROCESS WATER HOLDING TANK WITH MANHOLE ACCESS
APPROXIMATE LOCATION OF PROCESS WATER DISCHARGE (SINGLE EVENT)
FORMER MAARNG LATRINE

LEGEND:

BUILDING FOOTPRINT

FENCE

GRAVEL ROAD

0 20 40

SCALE IN FEET

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Wakefield, MA 01880
781-245-6606

LOADING BUILDING
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
1-5

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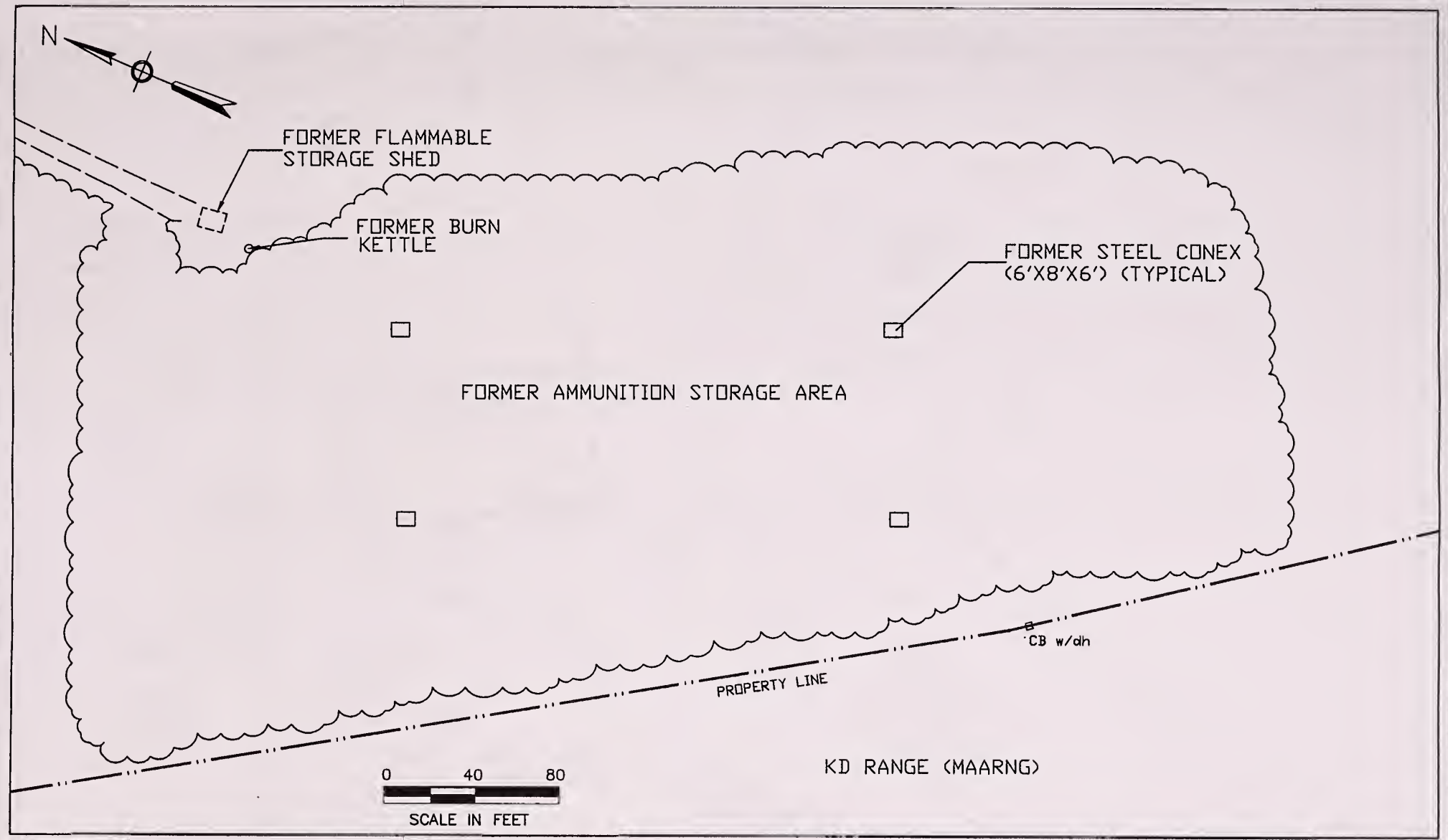

LEGEND

- TREE LINE
- BUILDING FOOTPRINT
- FENCE
- GRAVEL ROAD
- PROPERTY LINE

CB w/dh — CONCRETE BOUND WITH DRILL HOLE

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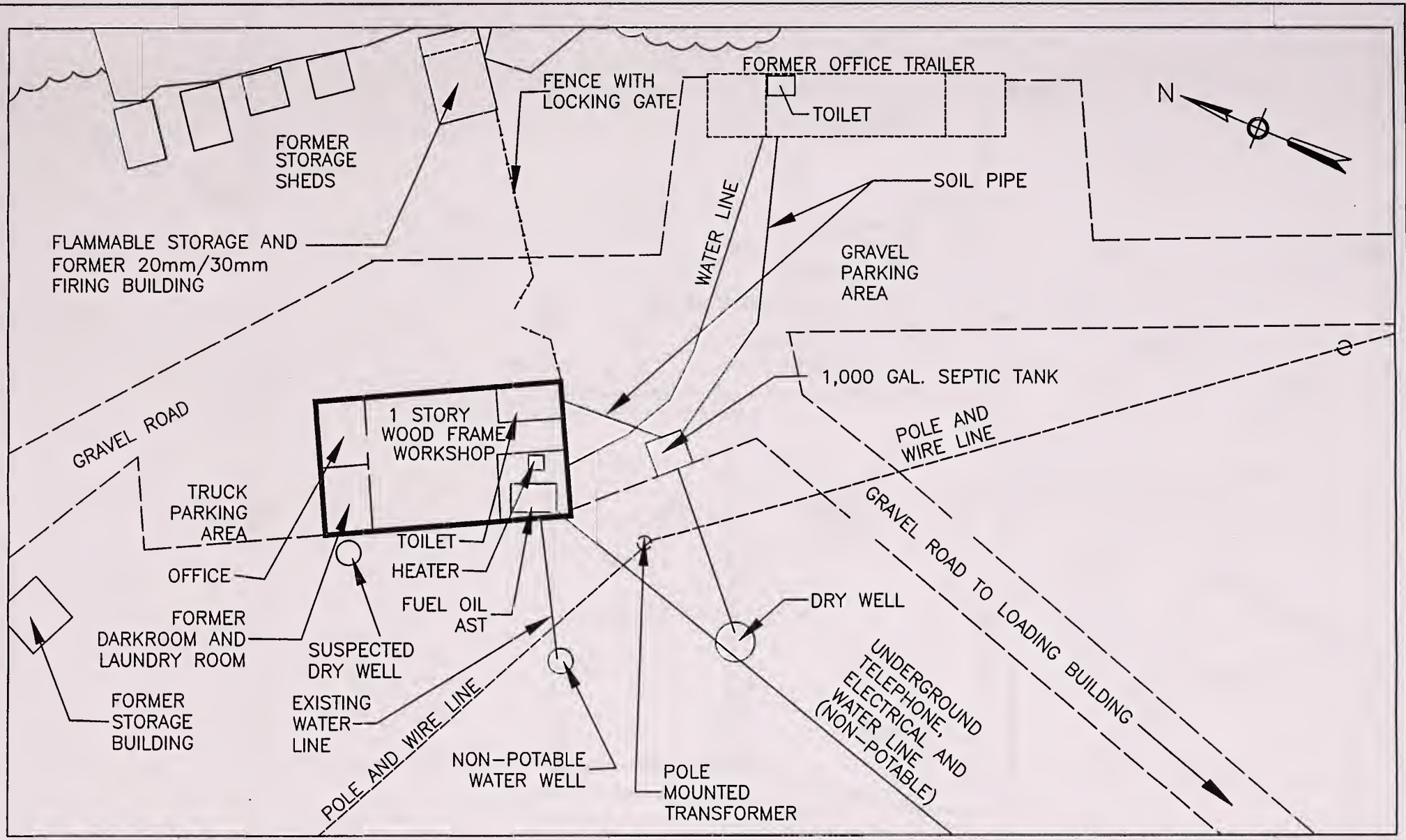
FORMER BURN KETTLE AND FLAMMABLE STORAGE AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
1-6

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854J.dwg	2/24/00	



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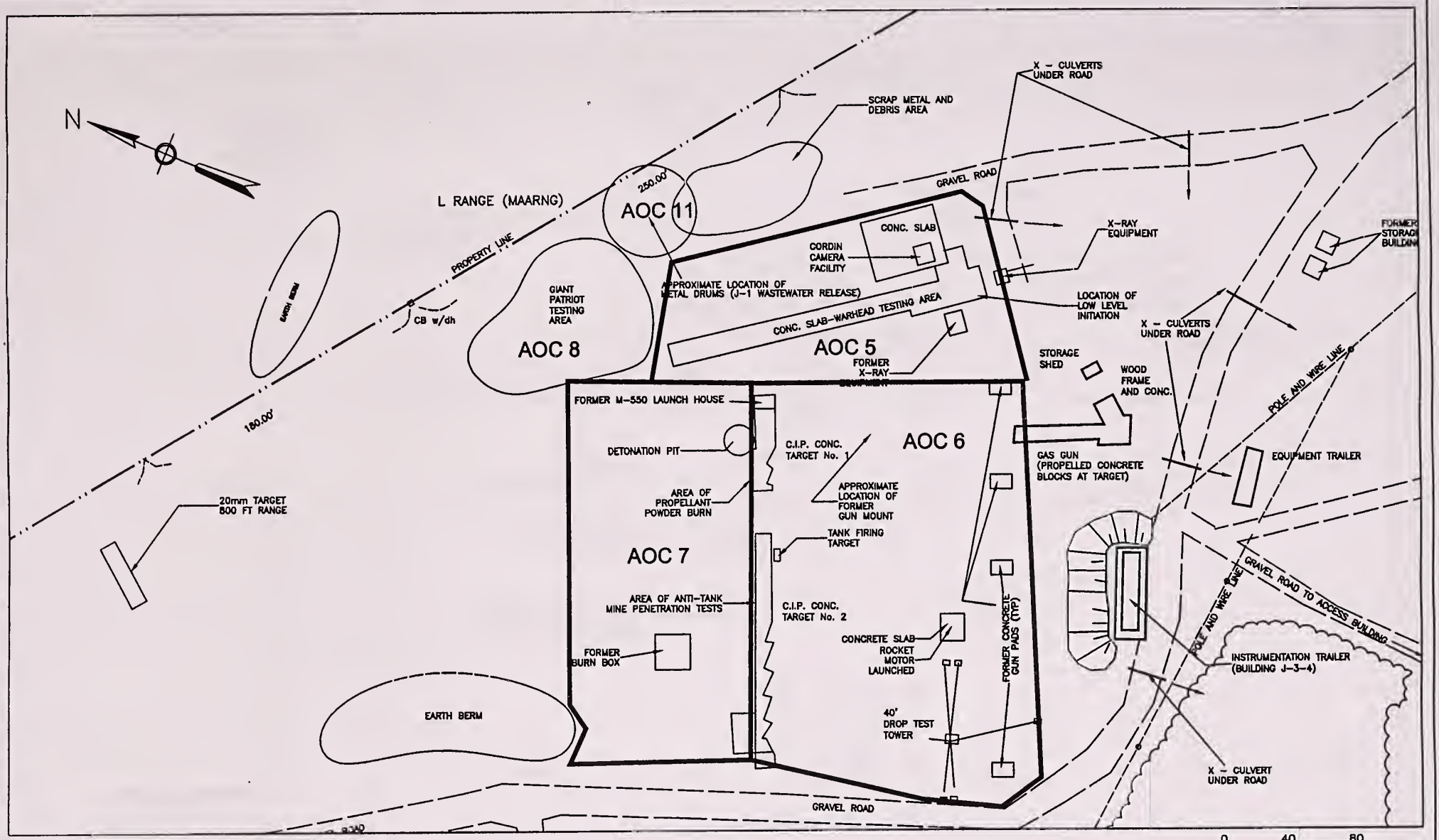
WORKSHOP
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
1-7

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854H.dwg	4/19/00	



LEGEND:
- AREAS OF DISCUSSION
- GRAVEL ROAD
- PROPERTY LINE
- C.I.P. CAST IN PLACE
- CB w/D\dh CONCRETE BOUND WITH DRILL HOLE

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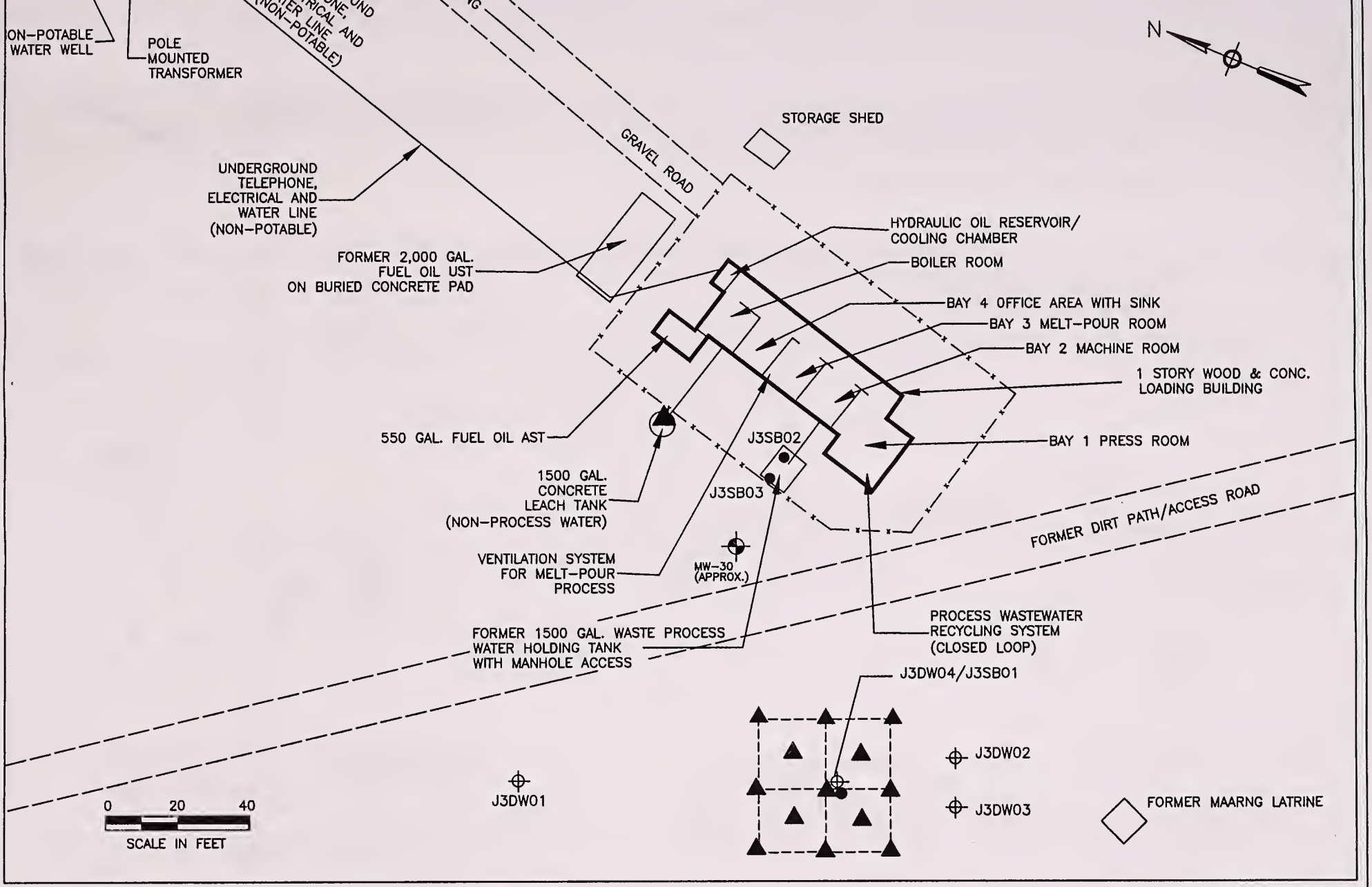
ARTILLARY RANGE, WARHEAD TESTING RANGE, GIANT PATRIOT TESTING AND DEMOLITION AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 1-8

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854F3.dwg	4/19/00	



LEGEND

- BUILDING FOOTPRINT
- FENCE
- GRAVEL ROAD
- J3SB01 — SOIL BORING AT LOCATION OF HIGHEST EXPLOSIVES DETECTION
- SURFACE SOIL/SEDIMENT SAMPLE LOCATION
- MONITORING WELL J3DW01

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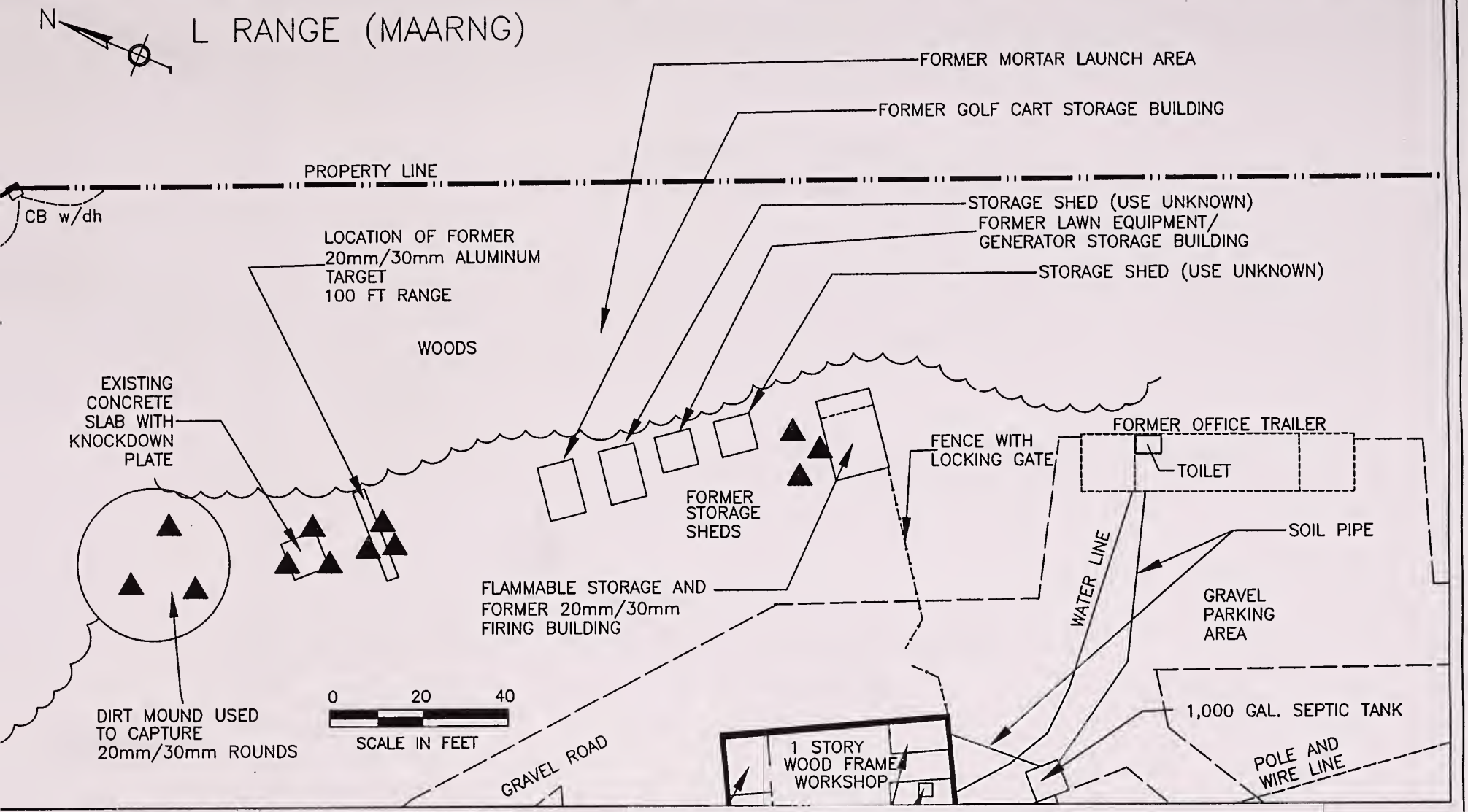
PHASE II ESA SAMPLING LOCATIONS
LOADING BUILDING
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 3-1

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	468541 2.dwg	4/20/00	



LEGEND:

- TREE LINE
- BUILDING FOOTPRINT
- FENCE
- GRAVEL ROAD
- PROPERTY LINE

CB w/dh CONCRETE BOUND WITH DRILL HOLE

HE HIGH EXPLOSIVES

▲ SURFACE SOIL SAMPLE LOCATION

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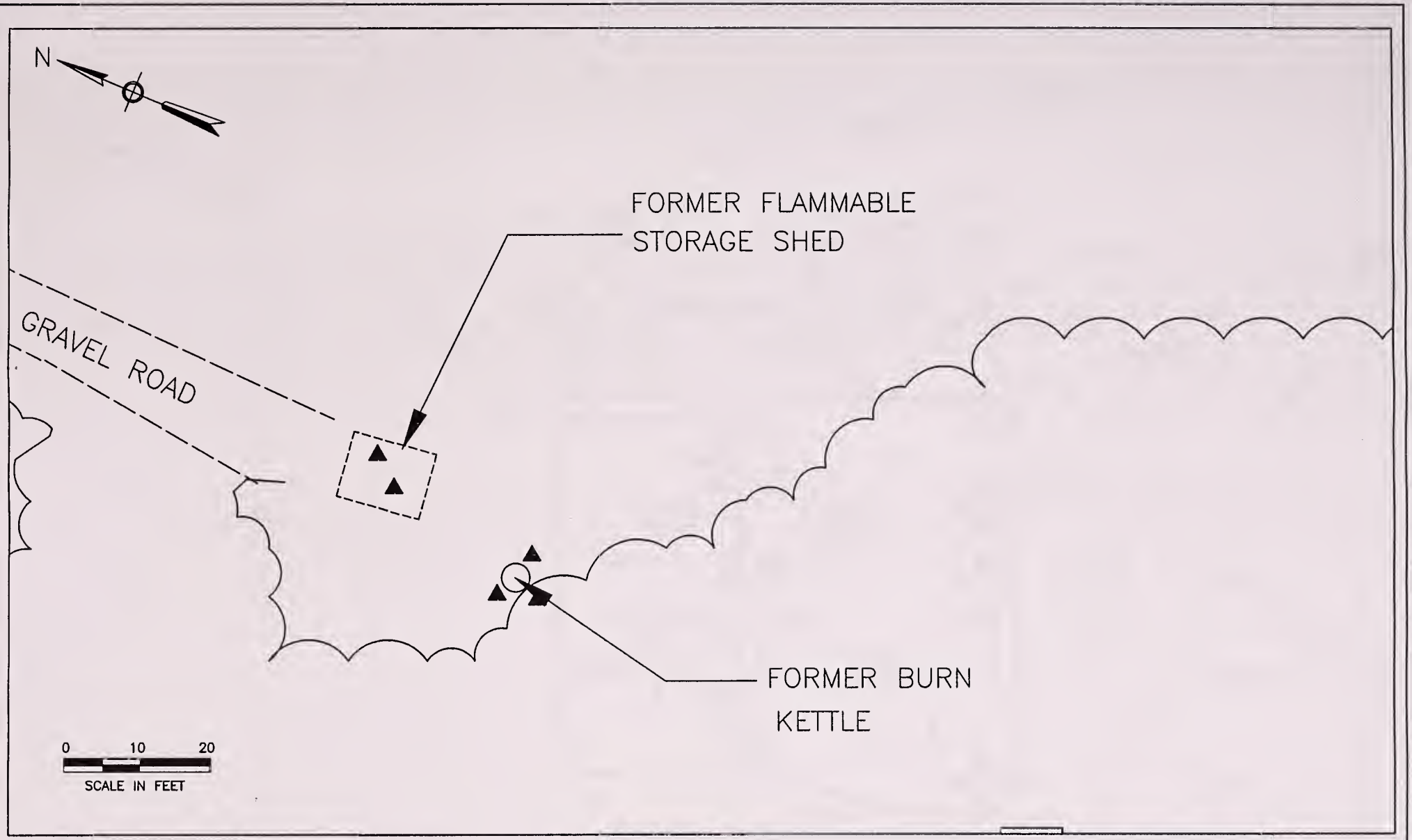
PHASE II ESA SAMPLING LOCATIONS
FLAMMABLE STORAGE AND
FORMER 20mm AND 30mm BUILDING
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 3-2

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854G2.dwg	4/12/00	



LEGEND:
TREE LINE
SURFACE SOIL SAMPLE

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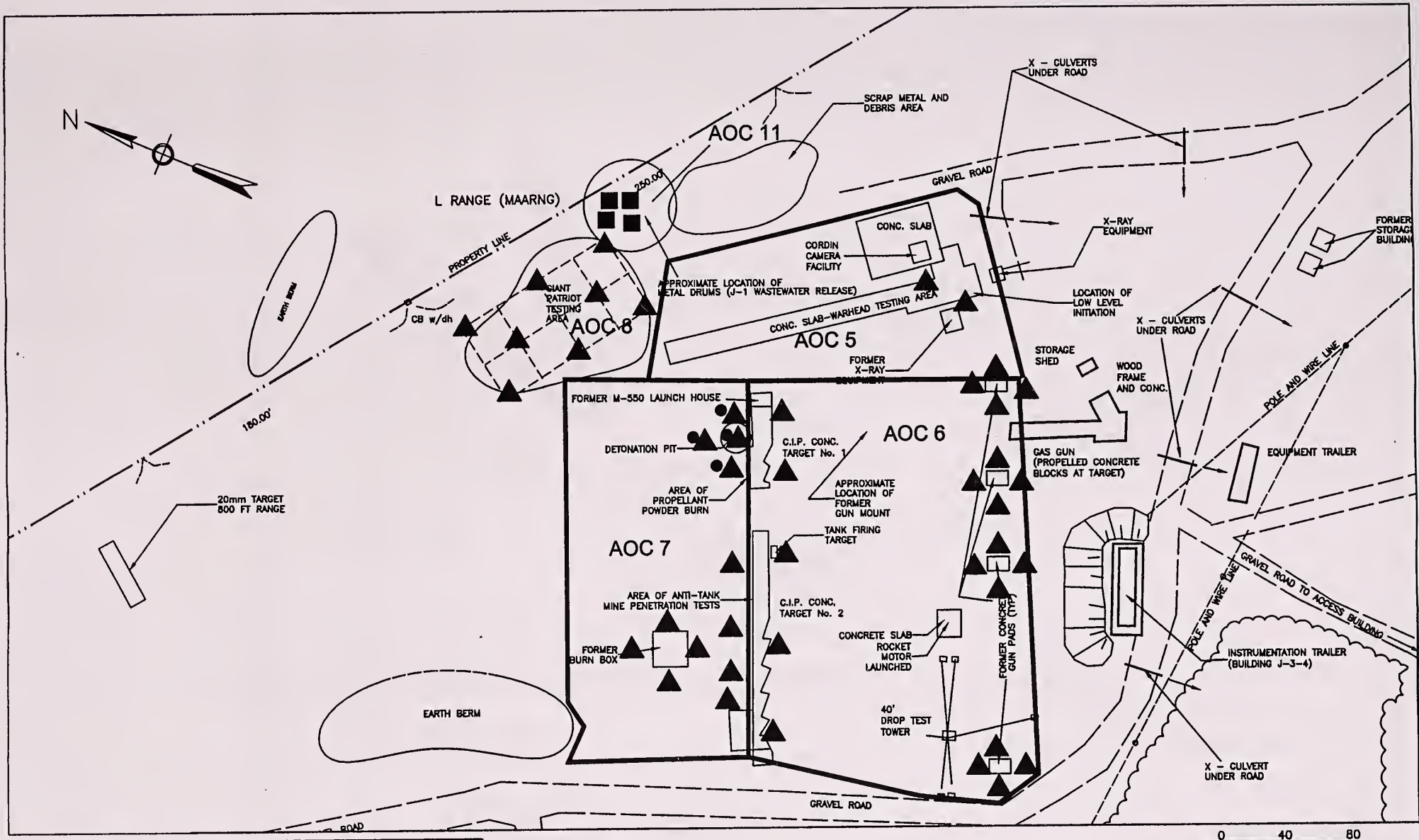
PHASE II ESA SAMPLING LOCATIONS
FORMER BURN KETTLE AND
FLAMMABLE STORAGE AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
3-3

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854J2.dwg	4/19/00	



LEGEND:

- AREAS OF DISCUSSION
- GRAVEL ROAD
- PROPERTY LINE
- C.I.P. CAST IN PLACE
- SURFACE SOIL SAMPLE LOCATION
- SUBSURFACE SOIL SAMPLES COLLECTED FROM BELOW BURIED DRUMS
- SOIL BORING
- CB w/D\dh CONCRETE BOUND WITH DRILL HOLE

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PHASE II ESA SAMPLING LOCATIONS
ARTILLARY RANGE, WARHEAD
TESTING RANGE, GIANT PATRIOT TESTING
AND DEMOLITION AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 3-4

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED
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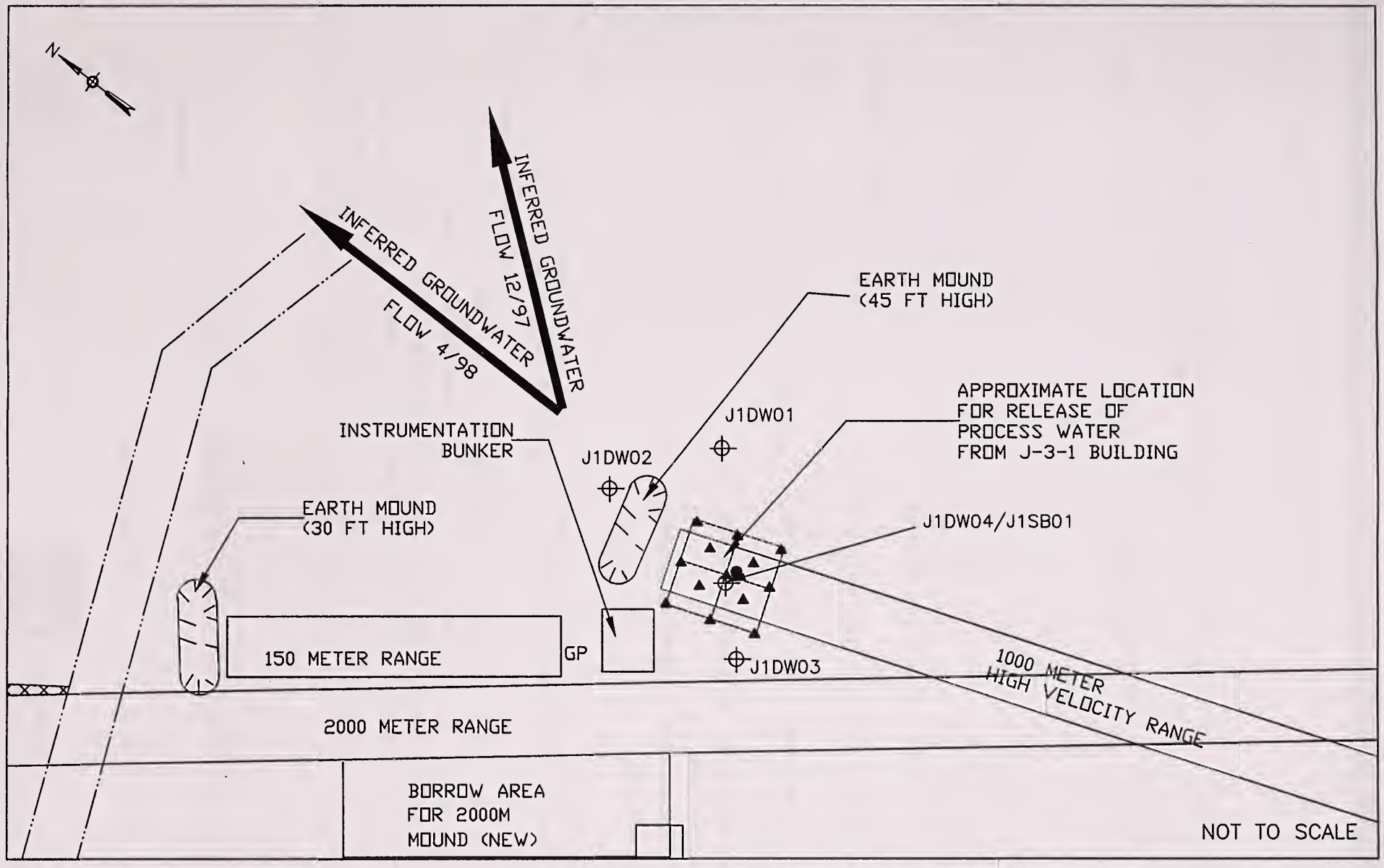

LEGEND:

- ● SOIL BORING AT LOCATION OF HIGHEST EXPLOSIVES HIT
- GP GUN POSITION
- ▲ SURFACE SOIL SAMPLE LOCATION
- ⊕ MONITORING WELL

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PHASE II ESA SAMPLING LOCATIONS
J-1 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
3-5

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854K2.dwg	4/19/00	

CALIBRATION DATA SHEET

Project _____

Job No. _____

Date _____

Field Instrumentation Calibration Data

Equipment Type/I.D.	Battery Condition	Calibration Information
_____	_____	pH 4 ____ pH 7 ____ pH 10 ____
_____	_____	pH 4 ____ pH 7 ____ pH 10 ____
_____	_____	pH 4 ____ pH 7 ____ pH 10 ____
_____	_____	Cond. Std. ____/ ____ Cond. Std. ____/ ____
_____	_____	Cond. Std. ____/ ____ Cond. Std. ____/ ____
_____	_____	Cond. Std. ____/ ____ Cond. Std. ____/ ____
Dissolved Oxygen		
_____	_____	Avg. Winkler Value ____ppm Meter Value ____ppm
Redox		
_____	_____	Zorbell Sol. Value ____ Meter Value ____
Photoionization Meter		
_____	_____	Zero/Zero Air? ❑ Yes ❑ No Span Gas Value ___ppm Equiv.
		Meter Value ___ppm Equiv.
_____	_____	Zero/Zero Air? ❑ Yes ❑ No Span Gas Value ___ppm Equiv.
		Meter Value ___ppm Equiv.
Other		
_____	_____	_____

Fluids/Materials Record

Deionized Water Source: [ ] ABB Staging [ ] Portable System [ ] Other_____

Trip Blank Water Source: [ ] ABB Lab; Lot No. _____ [ ] Other; ID_____

Decontamination Fluids: [ ] Methyl Hydrate; Lot No._____ [ ] Other_____ Lot No._____

Sampler Blank Water Source: [ ] ABB Staging [ ] Port .System [ ] Other_____

HNO^3/DI Rinse Solution: ABB Staging; I.D. No._____

Preservation Chemical Lot I.D.s: Chemicals Used: HNO^3 Lot No._____

H^2SO^4 Lot No._____

HCL Lot No._____

NaOH Lot No._____

ZnAOC Lot No._____

Filtration Paper ID:

Manuf/Type_____

Lot No._____

_____

Standards

Manuf._____

Lot No._____

Sampler Signature_____

HLA

FIGURE 3-6
CALIBRATION DATA SHEET

HARDING LAWSON ASSOCIATES

FIELD BORING LOG

BORING NO.:

PROJECT NO.:	PROJECT NAME:		PAGE OF
CONTRACTOR:	DRILLER:	DATE STARTED:	COMPLETED:
METHOD:	CASING SIZE:	OVM/TIP/HNU:	PROTECTION LEVEL:
GROUND ELEV.	SOIL DRILLED:	WATER LEVEL:	TOTAL DEPTH:
LOGGED BY:	CHECKED BY:	DATE:	

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6 INCHES	PEN REC	JAR HEADSPACE (ppm)	DESCRIPTION	NOTES

FIGURE 3-7
SOIL BORING LOG

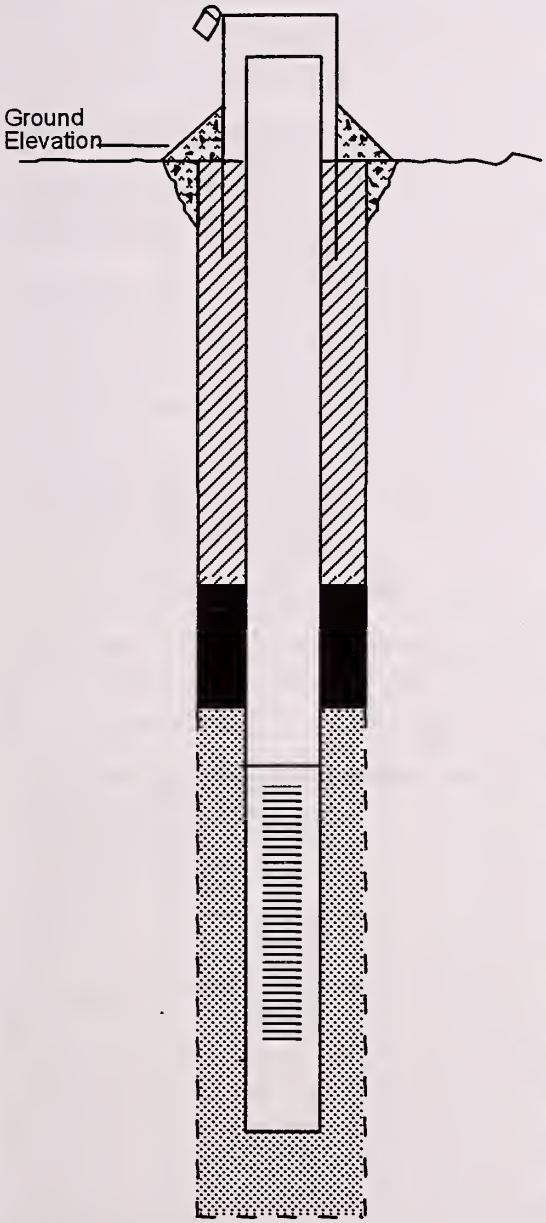
MONITORING WELL CONSTRUCTION DIAGRAM

Project _____ Boring No. _____ Driller _____

Project No. _____ Date Installed _____ Drilling Method _____

Development Method _____

Field Geologist _____



Stick-up of Casing Above Ground Surface: _____

Type of Surface Seal/ Other Protection: _____

Type of Surface Casing: _____

ID of Surface Casing: _____

Diameter of Borehole: _____

Riser Pipe ID: _____

Type of Riser Pipe: _____

Type of Backfill: _____

Depth of Top of Seal: _____

Type of Seal: _____

Depth of Top of Sand: _____

Depth of Top of Screen: _____

Type of Screen: _____

Slot Size x Length: _____

ID of Screen: _____

Type of Sandpack: _____

Depth of Bottom of Screen: _____

Depth of Sediment Sump with Plug: _____

Depth of Bottom of Borehole: _____

FIGURE 3-8
MONITORING WELL CONSTRUCTION DIAGRAM

HARDING LAWSON ASSOCIATES

MONITORING WELL SAMPLING LOG

WELL NUMBER: _____ DATE: _____

SAMPLING PERSONNEL: _____ LOCATION: _____

SHEET #_____ OF _____ CLIENT: _____

WEATHER: _____ JOB NUMBER: _____

WELL CONSTRUCTION MATERIAL: _____ STICK-UP (ft. from ground surface to top of casing - TOC): _____

WELL INTERIOR DIAMETER (id): _____ DISTANCE FROM TOC TO TOP OF RISER (TOR): _____

WELL RADIUS (r = 1/2 id): _____

INITIAL PID measurements (ppm): _____ PURGING METHOD: _____

WELL DEPTH (d; ft. from TOC or TOR - circle one):_____ PURGING EQUIPMENT:_____

STATIC WATER LEVEL (w; ft. from TOC or TOR - circle one):_____

STATIC WATER HEIGHT (h = d - w; ft.): _____

STATIC WATER VOLUME (V)
V = h (0.16); gallons for 2" well): _____
V = h (0.65); gallons for 4" well):
V = h (01.5); gallons for 6" well):

TOTAL VOLUME PURGED (GALLONS):_____

STATIC WATER LEVEL AFTER PURGING (ft. from TOC):_____

PARAMETER	VOLUME 1 GAL. =	VOLUME 2 GAL. =	VOLUME 3 GAL. =	VOLUME 4 GAL. =	VOLUME 5 GAL. =
pH (STANDARD UNITS)					
CONDUCTIVITY (MM / cm)					
TURBIDITY (NTUs)					
TEMPERATURE (C)					
TIME					

NOTES:

SAMPLE ID:_____ LABORATORY: _____

SAMPLE COLLECTION TIME: _____ PARAMETERS: _____

SAMPLE ID:_____ LABORATORY: _____

SAMPLE COLLECTION TIME: _____ PARAMETERS: _____

FIGURE 3-9
MONITORING WELL SAMPLING LOG

CHAIN OF CUSTODY RECORD

Page ___ of ___

PROJECT NO.	PROJECT NAME
SAMPLERS (SIGNATURE)	

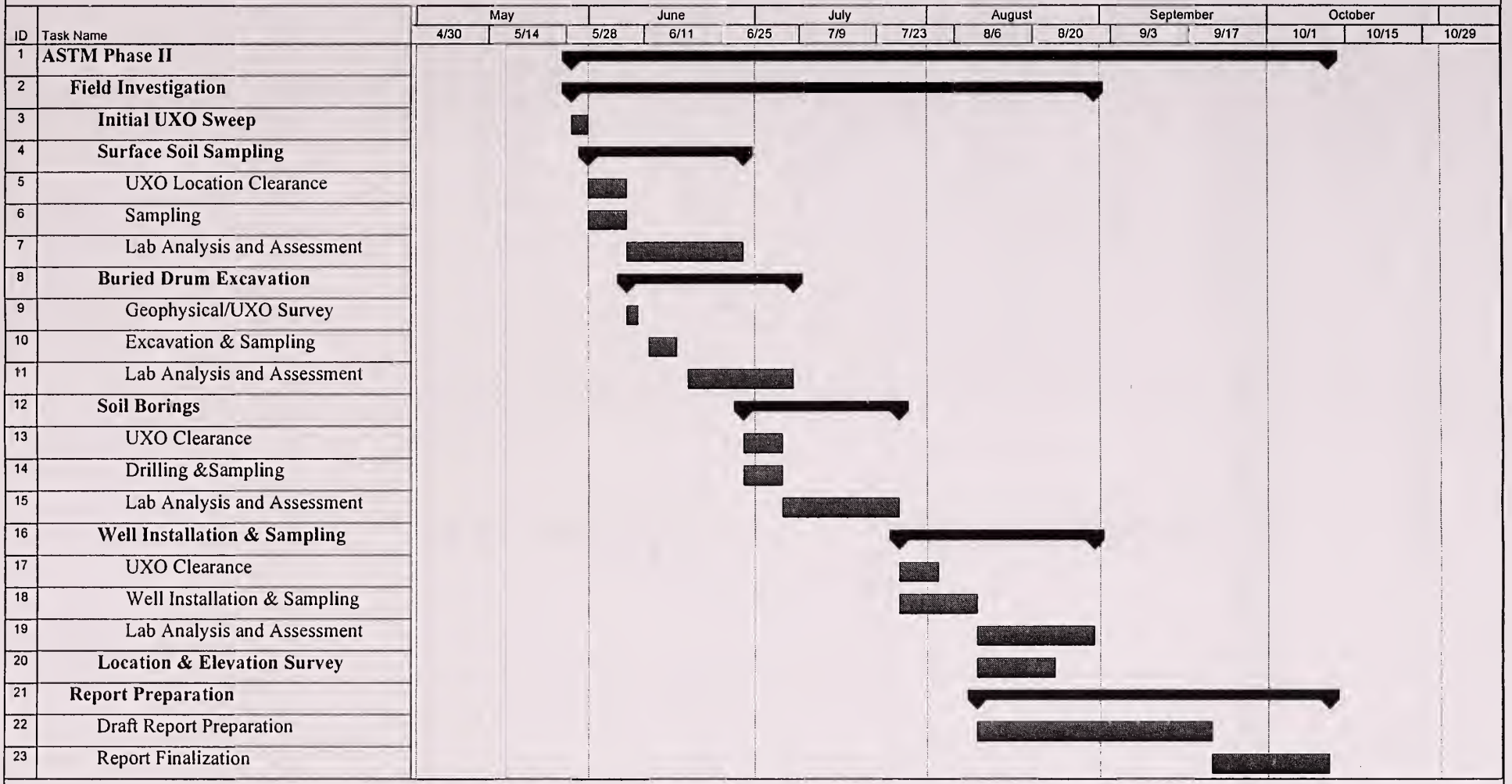
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	SAMPLE TYPE	REMARKS INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR DISPOSAL BY: (SIGNATURE)	DATE/TIME	REM/	

HLA

FIGURE 4-1
CHAIN OF CUSTODY RECORD

Figure 8-1 Field Investigation Schedule
J1 and J3 Range Phase II Site Investigation
Camp Edwards, Massachusetts



Project: J1&J3 Phase II
Date: Wed 4/19/00

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

q:w2\textron\j3\phase2\sap figure 8-1

TABLE 3-1: SUMMARY OF NON-EXPENDABLE EQUIPMENT

PHASE II SITE INVESTIGATION
J-1 AND J-3 RANGES
CAMP EDWARDS, MA

Item	Unit	Quantity
Environmental Monitoring Equipment		
PID Meter	Day	15
Water Level Meter	Day	5
Horiba U-10 Water Quality Meter	Day	3
Redox Meter	Day	3
O_2/LEL Meter	Day	15
Sampling Equipment		
Whale Pump Control Box	Day	0
Stainless Steel Sprayer	Week	5
Health & Safety		
Level D Protection Overboots Insulated Gloves Steel-Toed Boots Hard Hat Goggles Coveralls (cotton or Tyvek™)	Day/Per Person	10
Portable Eye Wash Station	Day	15
Fire Extinguisher, ABC	Week	3
First Aid Kit	Week	3
Radiation Monitor	Day	15
Draeger Pump	Day	15
Miscellaneous Equipment		
Camera, Film, Development	Roll	5
Mobile Phone	Day	15

TABLE 3-2: SUMMARY OF EXPENDABLE SUPPLIES

PHASE II SITE INVESTIGATION
J-1 AND J-3 RANGES
CAMP EDWARDS, MA

Item	Unit	Quantity
Gloves, Disposable	Box	2
Marking Pens	Each	2
Tape, Duct	Roll	1
Tape, Clear	Roll	2
Tape, Filament	Roll	2
Decontamination Fluid		
Liquinox	Gallon	1
Deionized Water	Gallon	15
Decon Package		
Washtubs	Each	3
Kimwipes	Box	2
Paper Towels	Roll	5
Baggies	Box	5
Tyvek™ Suits	Each	10
Ice	Bag	15
Bubble Pack	Foot	50
Polyethylene Tubing	Foot	500
Whale Submersible Pumps	Each	0
Log Book	Each	1
Trash Bags	Box	2
SS Spoons	Each	10
SS Spatulas	Each	25
Plastic Sheeting	Roll	1
Flagging	Each	75
Span Gas for PID	Each	2
Tape Dispenser, Filament	Each	2
Tape Dispenser, Clear	Each	2
Miscellaneous Sample Containers	Each	1

Table 3-3 Summary of Sampling and Analytical Program
Phase II Environmental Site Assessment
J Ranges
Camp Edwards Massachusetts

Area of Concern	Surface Soil (0-6")				Subsurface Soil				Ground Water				Sediment/ Sludge				Comments
	Explosives	Metals	VOCs/VPH	EPH	Explosives	Metals	VOCs/VPH	EPH	Explosives	Metals	VOCs/VPH	EPH	Explosives	Metals	VOCs/VPH	EPH	
1. Explosives Loading Building																	
a Leach Tank													1				Possible explosives from hand washing, etc.
b Former Holding Tank					2												2 borings to 16 ft. 1 sample per boring below former base of tank, archive deeper for possible later analysis.
c Process Water Discharge Area	13				1				3								13 surface samples from grid, 1 boring at hot spot w/ 1 lab samples from unsaturated zone (2-4 ft.). Deeper samples held for possible analysis. Install & sample 3 SDDWs.
2. 20 mm Range																	
a 100' range	12	12															3 grabs each at gun position, target, knockdown, and berm.
3. Burn Kettle/Flam. Storage Shed																	
a Former Burn Kettle Area	3	3		3													3 Surface soil samples
b Former Shed				2													2 Surface soil samples
4. Workshop																	
a Photo Developer/ Laundry Drywell														1			Possible metals from photo development
5. Warhead Firing Range																	
a Detonation chamber	2	2															
6. Artillery Range																	
a Concrete Pad Gun Mounts (4)	8	8															2 composite samples at each pad
b Target 1/ 550 House	2	2															Grab samples in front of target
c Target 2	3	3															Grab samples in front of target
7. Demolition Area																	
a Burn Box	4	4		4													4 Grab surface soil samples
b Demo Area	8	8		8	4			4									4 Borings to 16 ft. Analyze 2-4 ft.; hold rest for possible analysis.
8. Giant Patriot Testing Area	8																Grid-based sampling proposed. Test location needs to be confirmed with air photos
9. Assembly Building Septic														1			Address photochemicals in septic tank
10. J-1 Range																	
a Process Water Disposal Area	13				1				3								13 surface samples from grid, 1 boring at hot spot w/ 1 lab samples from unsaturated zone (2-4 ft.). Deeper samples held for possible analysis. Install & sample 3 SDDWs.
11. Empty Drum Burial Area					4												Collecton of samples upon removal of buried drums
Totals:	76	42	0	17	12	0	0	4	6	0	0	0	1	2	0	0	
QA/QC Samples																	
Duplicates	8	4	0	2	2	0	0	1	1	0	0	0	1	1	0	0	One per 10 samples
Equipment Rinsate Blanks	6	3	0	2	2	0	0	1	1	0	0	0	1	1	0	0	One per 20 samples per decon event
Trip Blanks																	With every shipment of VOCs
MS/MSDS	4	3	0	1	1	0	0	1	1	0	0	0	1	1	0	0	One per 20 samples
Totals:	94	52	0	22	17	0	0	7	9	0	0	0	4	5	0	0	

Methods:
Explosives: EPA Method 8330
Priority Pollutant Metals: SW-846, 6000/7000 series
EPH: MADEP Method
All soil samples will be screened with a PID for the presence of VOCs, in accordance with MADEP guidance.
Lab VOC analyses will be performed by EPA Method 8260 or MADEP VPH, as appropriate, only if positive detections by screening.

TABLE 3-4
SUMMARY OF ANALYTICAL METHODS
PHASE II ENVIRONMENTAL SITE ASSESSMENT
J-RANGES
CAMP EDWARDS, MASSACHUSETTS

ANALYTES		SOIL			WATER		
		SAMPLE PREP METHOD[1]	ANALYTICAL METHOD	LAB QUANTITATION LIMITS	SAMPLE PREP METHOD	ANALYTICAL METHOD	LAB QUANTITATION LIMITS
VOC (TCL) w/TICs		EPA 5035	EPA 8260B	250 ug/kg	EPA 5030B	EPA 8260B	1 to 5 ug/L
VPH	C_5-$C_{8\ al}$		MADEP[2]	2-10 mg/kg		MADEP[2]	50-100 ug/l
	C_9-$C_{12\ al}$			2-10 mg/kg			50-100 ug/l
	C_9-$C_{10\ ar}$			2-10 mg/kg			50-100 ug/l
VPH Target Compounds				0.1-0.2 mg/kg			1-10 ug/l
EPH	C_9-$C_{18\ al}$		MADEP[2]	2-10 mg/kg		MADEP[2]	50-100 ug/l
	C_{19}-$C_{36\ al}$			2-10 mg/kg			50-100 ug/l
	C_{11}-$C_{22\ ar}$			2-10 mg/kg			50-100 ug/l
EPH Target PAHs				0.5-1 mg/kg			1-5 ug/L
Priority Pollutant Metals							
Antimony	Sb		6010	12 mg/kg		6010	60 µg/L
Arsenic	As		6010	2.0 mg/kg		6010	10 µg/L
Beryllium	Be		6010	1.0 mg/kg		6010	5 µg/L
Cadmium	Cd		6010	1.0 mg/kg		6010	5 µg/L
Chromium, total	Cr		6010	2.0 mg/kg		6010	10 µg/L
Copper	Cu		6010	5.0 mg/kg		6010	25 µg/L
Lead	Pb		6010	0.6 mg/kg		6010	3 µg/L
Mercury	Hg		7470/7471	0.1 mg/kg		7470/7471	0.2 µg/L
Nickel	Ni		6010	8.0 mg/kg		6010	40 µg/L
Selenium	Se		6010	1.0 mg/kg		6010	5 µg/L
Silver	Ag		6010	2.0 mg/kg		6010	10 µg/L
Thallium	Tl		6010	2.0 mg/kg		6010	10 µg/L
Zinc	Zn		6010	4.0 mg/kg		6010	20 µg/L
Explosives[3]							
HMX			8330	120 µg/kg		8330	0.25 µg/L
RDX			8330	120 µg/kg		8330	0.25 µg/L
1,3,5-Trinitrobenzene			8330	120 µg/kg		8330	0.25 µg/L
1,3- Dinitrobenzene			8330	120 µg/kg		8330	0.25 µg/L
Tetryl			8330	120 µg/kg		8330	0.25 µg/L
Nitrobenzene			8330	120 µg/kg		8330	0.25 µg/L
2,4,6-Trinitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
4-Amino-2,6-dinitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
2-Amino-4,6-dinitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
2,6-Dinitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
2,4-Dinitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
Picric Acid			8330	120 µg/kg		8330	0.25 µg/L
2-Nitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
4-Nitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
3-Nitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
2,6-Diamino-4-nitrotoluene			8330	250 µg/kg		8330	0.50 µg/L
2,4-Diamino-6-nitrotoluene			8330	120 µg/kg		8330	0.25 µg/L
PETN			8330	5000 µg/kg		8330	10.0 µg/L
Nitroglycerin			8330	2500 µg/kg		8330	5.0 µg/L

NOTES:

1. Refers to EPA - specified methods per EPA SW-846 Revision 4 (1996) unless noted otherwise.
2. Massachusetts Department of Environmental Protection method for TPH (MADEP, 1998a, 1998b).
3. Including Photo Diode Array (PDA) confirmation of detected compounds.

VOC = Volatile Organic Compounds
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractabel Petroleum Hydrocarbons
TCL = Target Compound List
TICs = Tentatively Identified Compounds

TABLE 3-5

ANALYTICAL DQOS (PRECISION FOR TCL VOCs)
PHASE II SI
J-RANGES
CAMP EDWARDS,
MASSACHUSETTS

PARAMETER		PRECISION WATER	PRECISION SOIL
			RPD BY FIELD DUPLICATES
TCL VOCs		30	50
	Volatiles		RPD BY MATRIX SPIKES
TCL VOCs	1,1-Dichloroethene	14	22
TCL VOCs	Trichloroethane	14	24
TCL VOCs	Chlorobenzene	13	21
TCL VOCs	Toluene	13	21
TCL VOCs	Benzene	11	21

TABLE 3-6

ANALYTICAL DQOS (ACCURACY FOR TCL VOCs)
PHASE II SI
J-RANGES
CAMP EDWARDS,
MASSACHUSETTS

		ACCURACY	
FRACTION		**WATER**	**SOIL**
	Volatiles	PERCENT RECOVERY BY MATRIX SPIKES	
TCL VOCs	1,1-Dichloroethene	61-145	59-172
TCL VOCs	Trichloroethane	71-120	62-137
TCL VOCs	Chlorobenzene	75-130	60-133
TCL VOCs	Toluene	76-125	59-139
TCL VOCs	Benzene	76-127	66-142
	Volatiles	PERCENT RECOVERY BY SURROGATE SPIKES	
TCL VOCs	4-Bromofluorobenzene	86-115	74-121
TCL VOCs	1,2 Dichloroethane-d4	80-120	80-120
TCL VOCs	Toluene-d8	88-110	81-117
TCL VOCs	DBFM	86-118	80-120

TABLE 3-7

ANALYTICAL DQOS FOR EPH
PHASE II SI
J-RANGES
CAMP EDWARDS,
MASSACHUSETTS

PARAMETER		SOIL		WATER	
		Accuracy (%R)	Precision (%RPD)	Accuracy (%R)	Precision (%RPD)
EPH					
	Surrogates	40-140	NA	40-140	NA
	LCS Analytes	40-140	NA	40-140	NA
	MS/MSD	40-140	50	40-140	50

TABLE 3-8

ANALYTICAL DQOS FOR METALS
PHASE II SI
J-RANGES
CAMP EDWARDS,
MASSACHUSETTS

PARAMETER	SOIL		WATER	
	Accuracy (%R)	Precision (%RPD)	Accuracy (%R)	Precision (%RPD)
Priority Pollutant Metals	75-125	20(h)	75-125	20(h)

TABLE 3-9

ANALYTICAL DQOS FOR EXPLOSIVES
PHASE II SI
J-RANGES
CAMP EDWARDS, MASSACHUSETTS

PARAMETER	SOIL		WATER	
	Accuracy (%R)	Precision (%RPD)	Accuracy (%R)	Precision (%RPD)
HMX	73-103	30	67-97	30
RDX	75-109	30	70-105	30
1,3,5-Trinitrobenzene	80-110	30	74-104	30
1,3- Dinitrobenzene	81-111	30	77-107	30
Tetryl	49-113	30	72-102	30
Nitrobenzene	80-110	30	77-107	30
2,4,6-Trinitrotoluene	75-105	30	72-102	30
4-Amino-2,6-dinitrotoluene	81-111	30	76-106	30
2-Amino-4,6-dinitrotoluene	81-111	30	74-104	30
2,6-Dinitrotoluene	78-110	30	79-109	30
2,4-Dinitrotoluene	81-111	30	77-107	30
Picric Acid	45-128	30	10-58	30
2-Nitrotoluene	82-112	30	76-106	30
4-Nitrotoluene	81-111	30	75-105	30
3-Nitrotoluene	80-110	30	73-103	30
2,6-Diamino-4-nitrotoluene	72-106	30	28-107	30
2,4-Diamino-6-nitrotoluene	60-119	30	34-91	30
PETN	80-110	30	62-115	30
Nitroglycerin	68-127	30	52-136	30

TABLE 3-10
CONTAINERS, SAMPLE VOLUMES, PRESERVATION, AND HOLD TIME REQUIREMENTS

SAMPLING AND ANALYSIS PLAN
PHASE II SITE INVESTIGATION
J-RANGES
CAMP EDWARDS, MASSACHUSETTS

Medium/Parameter	Container	Preservative	Holding Time
Water Testing			
Volatile Organic Compounds (VOCs)	2 40-mL glass vials with Teflon™ septa, no headspace	Ice to 4 ° C HCl to pH <2	Analyze within 14 days
Volatile Petroleum Hydrocarbons (VPH)	2 40-mL glass vials with Teflon™ septa, no headspace	Ice to 4 ° C HCl to pH <2	Analyze within 14 days
Semivolatile Organic Compounds (SVOCs)	2 1-liter amber glass bottles with Teflon™-lined lid, headspace	Ice to 4 ° C	Extract within 7 days; analyze within 40 days of extraction
Extractable Petroleum Hydrocarbons (EPH)	2 1-liter amber glass bottles with Teflon™-lined lid, headspace	Ice to 4 ° C	Extract within 7 days; analyze within 40 days
Priority Pollutant Metals	1 1-Liter polyethylene	HNO3 Ice to 4 ° C	Extract within 28 days; analyze within 6 months
Explosives	2 1-liter amber glass bottles with Teflon™-lined lid, headspace	Ice to 4 ° C	Extract within 7 days; analyze within 40 days
Soil Testing			
Volatile Organic Compounds (VOCs)	Add 15 g soil to 1 40-mL glass vial with Teflon™ septum	15 ml methanol Ice to 4 ° C	Analyze within 14 days
Volatile Petroleum Hydrocarbons (VPH)	Add 15 g soil to 1 40-mL glass vial with Teflon™ septum	15 ml methanol Ice to 4 ° C	Analyze within 14 days
Semivolatile Organic Compounds (SVOCs)	1 8-oz wide-mouth glass jar, 3/4 full with Teflon™-lined lid	Ice to 4 ° C	Extract within 14 days; analyze within 40 days of extraction
Extractable Petroleum Hydrocarbons (EPH)	1 8-oz wide-mouth glass jar, 3/4 full with Teflon™-lined lid	Ice to 4 ° C	Extract within 14 days; analyze within 40 days of extraction
Priority Pollutant Metals	1 4-oz glass jar	Ice to 4 ° C	Extract within 28 days; analyze within 6 months
Explosives	2 4-oz glass jars with Teflon™-lined lid	Ice to 4 ° C	Extract within 14 days; analyze within 40 days of extraction

APPENDIX A

DATA EVALUATION STANDARD OPERATING PROCEDURES FOR EXTRACTABLE PETROLEUM HYDROCARBONS (EPH)

DATA EVALUATION STANDARD OPERATING PROCEDURES
FOR EXTRACTABLE PETROLEUM HYDROCARBONS (EPH)

SITE: _____ PROJECT #: _____
LAB: _____ BOX #: _____
Reviewer's Signature _____ Date: _____

Sample IDs:

		Yes	No	NA
1.0	**Hold Times (aqueous and soil samples)**			
	Extracted within 7 days of collection?	[ ]	[ ]	[ ]
	Analyzed within 40 days of collection?	[ ]	[ ]	[ ]

ACTION: If no, flag positive and non-detect results as estimated (J).

Aqueous samples preserved to pH < 2?	[ ]	[ ]	[ ]

ACTION: If no, note in data review summary report.

2.0 Surrogate Recovery

Surrogate recoveries for OTP and COD should fall in the range of 40 to 140 %.

Do surrogate recoveries fall within 40 to 140%?	[ ]	[ ]

ACTION: If the surrogate recovery is > %10 but outside the recovery limits:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as estimated detection limits (UJ) when recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

ACTION: If the surrogate recovery is < %10:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as unusable (R).

3.0 Calibration

Was a calibration curve developed with a minimum of 5 concentrations levels?	[ ]	[ ]	
Was the linearity of calibration or response factors stable over the concentration range of the calibration? (%RSD less than or equal to 25%)	[ ]	[ ]	[ ]
If linear regression analysis was used for quantitation was the correlation coefficient (r) greater than or equal to 0.99?	[ ]	[ ]	[ ]

ACTION: If %RSD >%25 or correlation coefficient less than 0.99:

1. Flag all positive and non-detect results as estimated (J).

	Yes	No	NA
4.0 Laboratory Calibration Check Standard			
Was a mid-range calibration check standard analyzed prior to sample analysis to verify the calibration state of the instrument?	[ ]	[ ]	[ ]
Was a mid-range calibration check standard analyzed after the analysis of the 10th sample?	[ ]	[ ]	[ ]
Were the RPDs < 25%?	[ ]	[ ]	[ ]
If yes, was a new calibration curve prepared?	[ ]	[ ]	[ ]

ACTION: If the RPD is >%25 and no new calibration curve was prepared or if no calibration check standard was analyzed at a minimum with every batch of 20 samples or less:

1. Flag all positive and non-detect results as estimated (J).

5.0 Laboratory Method Blank			
Was a laboratory method blank prepared and analyzed for each batch of samples?	[ ]	[ ]	
Were any peaks detected within the retention time window of any analyte?	[ ]	[ ]	

ACTION: If any method blank data are missing contact the lab for resubmittals.

If peaks were detected within the retention time window of an analyte:

Compare hydrocarbon fingerprint in blank to sample fingerprint to determine possible associations. Use professional judgment to determine qualification. Record technical basis of decision in validation report.

6.0 Component Spike			
Was a component spike sample prepared and analyzed for each batch of samples?	[ ]	[ ]	
Do component spike recoveries fall within 40 to 140%?	[ ]	[ ]	

ACTION: If the component spike recovery is >%10 but falls outside the recovery limits:

1. Flag positive results as estimated (J) in all associated samples.
2. Flag all non-detects as estimated detection limits (UJ) when

recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

ACTION: If the surrogate recovery is < %10:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as unusable (R).

	Yes	No
7.0 Laboratory Fortified Matrix (LFM) Spike		
Was a LFM spike sample prepared and analyzed for each batch of samples?	[ ]	[ ]
Do LFM spike recoveries fall within 40 to 140%?	[ ]	[ ]

ACTION: If the LFM spike recovery is >%10 but falls outside the recovery limits:

1. Flag all positive results in spiked sample as estimated (J). Use professional judgement for qualification of associated samples from similar media.
2. Flag all non-detects as estimated detection limits (UJ) when recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

ACTION: If the surrogate recovery is < %10:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as unusable (R).

8.0 Sample Duplicate		
Was a laboratory or field duplicate sample analyzed with every batch?	[ ]	[ ]
Were RPDs < 50%?	[ ]	[ ]

ACTION: If the RPD is >%50:

1. Flag all positive and non-detect results for the original sample and its duplicate as estimated (J). Use professional judgement for associated samples.

Notes:

REFERENCES:

Reported QC limits are specified in the Method For The Determination Of Extractable Petroleum Hydrocarbons (EPH), MADEP, January 1998. Actions are based on actions specified for organic methodologies in the USEPA CLP National Functional Guidelines for Organic Data Review, February 1994, or professional judgment.

APPENDIX B

DATA EVALUATION STANDARD OPERATING PROCEDURES FOR VOLATILE PETROLEUM HYDROCARBONS (VPH)

DATA EVALUATION STANDARD OPERATING PROCEDURES FOR VOLATILE PETROLEUM HYDROCARBONS (VPH)[1]

SITE: _____ PROJECT #: _____
LAB: _____ BOX #: _____
Reviewer's Signature _____ Date: _____

Sample IDs:

1.0 **Hold Times (aqueous and soil samples)**	Yes	No	NA
Were soils preserved in MeOH ?	[ ]	[ ]	[ ]
Analyzed within 28 days of collection?	[ ]	[ ]	[ ]

ACTION: If no, flag positive and non-detect results as estimated (J).

Aqueous samples preserved to pH < 2?	[ ]	[ ]	[ ]
Analyzed in 14 days?	[ ]	[ ]	[ ]

ACTION: If no, note in data review summary report.

2.0 Surrogate Recovery

Surrogate recovery for 2,5-Dibromotoluene should fall in the range of 70 to 130 %.

Do surrogate recoveries fall within 70 to 130%?	[ ]	[ ]

ACTION: If the surrogate recovery is > %10 but outside the recovery limits:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as estimated detection limits (UJ) when recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

ACTION: If the surrogate recovery is < %10:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as unusable (R).

3.0 Calibration

Was a calibration curve developed with a minimum of 5 concentrations levels?	[ ]	[ ]	
Was the linearity of calibration or response factors stable over the concentration range of the calibration? (%RSD less than or equal to 25%)	[ ]	[ ]	[ ]

If linear regression analysis was used for quantitation was the correlation coefficient (r) greater than or equal to

0.99? [ ] [ ] [ ]

ACTION: If %RSD >%25 or correlation coefficient less than 0.99:
1. Flag all positive and non-detect results as estimated (J).

		Yes	No	NA
4.0	**Laboratory Calibration Check Standard**			
	Was a mid-range calibration check standard analyzed prior to sample analysis to verify the calibration state of the instrument?	[ ]	[ ]	[ ]
	Was a mid-range calibration check standard analyzed after the analysis of the 10th sample?	[ ]	[ ]	[ ]
	Were the RPDs < 25%?	[ ]	[ ]	[ ]
	If yes, was a new calibration curve prepared?	[ ]	[ ]	[ ]

ACTION: If the RPD is >%25 and no new calibration curve was prepared or if no calibration check standard was analyzed at a minimum with every batch of 20 samples or less:

1. Flag all positive and non-detect results as estimated (J).

5.0 Laboratory Method Blank

Was a laboratory method blank prepared and analyzed for each batch of samples? [ ] [ ]

Were any peaks detected within the retention time window of any analyte? [ ] [ ]

ACTION: If any method blank data are missing contact the lab for resubmittals.

If peaks were detected within the retention time window of an analyte:

Compare hydrocarbon fingerprint in blank to sample fingerprint to determine possible associations. Use professional judgment to determine qualification. Record technical basis of decision in validation report.

6.0 Component Spike

Was a component spike sample prepared and analyzed for each batch of samples? [ ] [ ]

Do component spike recoveries fall within 70 to 130%? [ ] [ ]

ACTION: If the component spike recovery is >%30 but falls outside the recovery limits, apply the following actions to all samples associated with the component spike:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as estimated detection limits (UJ) when recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

	Yes	No

7.0 Laboratory Fortified Matrix (LFM) Spike

Was a LFM spike sample prepared and analyzed for each batch of samples?	[ ]	[ ]
Do LFM spike recoveries fall within 70 to 130%?	[ ]	[ ]

ACTION: If the LFM spike recovery is >%10 but falls outside the recovery limits, apply the following action to the unspiked sample associated with the LFM spike:

1. Flag all positive results as estimated (J).
2. Flag all non-detects as estimated detection limits (UJ) when recoveries are less than the lower acceptance limit.
3. If recoveries are greater than the upper acceptance limit, do not qualify non-detects.

8.0 Sample Duplicate

Was a laboratory or field duplicate sample analyzed with every batch?	[ ]	[ ]
Were RPDs < 50%?	[ ]	[ ]

ACTION: If the RPD is >%50:

1. Flag all positive and non-detect results for the original sample and its duplicate as estimated (J).

9.0 Trip Blank

Was a trip blank prepared and analyzed for each batch of samples?	[ ]	[ ]
Were any peaks detected within the retention time window of any analyte?	[ ]	[ ]

ACTION: If peaks were detected within the retention time window of an analyte:

Compare hydrocarbon fingerprint in blank to sample fingerprint to determine possible associations. Use professional judgment to determine qualification. Record technical basis of decision in validation report.

REFERENCES:

[1]Reported QC limits are those reported in the Method For The Determination Of Volatile Petroleum Hydrocarbons (VPH), (Public Comment Draft 1.0), MADEP, August 1995. And actions reported are those actions reported in the USEPA CLP National Functional Guidelines for Organic Data Review, February, 1994 or professional judgement.

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